

Effectiveness of Interventions for Overweight and Obesity in Children and Adolescents

Prepared for:

Department of Health and Hospitals

Contract No.

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January 30, 2004

PREPARATION OF THIS LITERATURE REVIEW

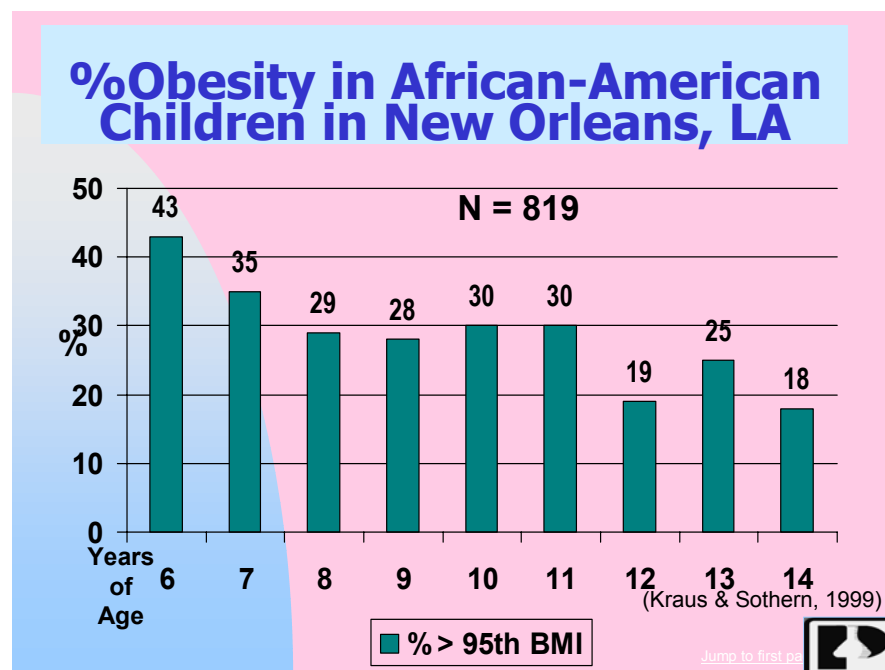
The authors worked with three members of DHH throughout the review (see Acknowledgments) and during October 2003 presented a working outline. After feedback, the literature search and interim report were completed between October 15, 2003 and January 7, 2004. The preliminary report was distributed for broad-based review to the previously mentioned DHH staff on January 7th. Following initial presentation of the report to Senator Bajoie, and the DHH staff on January 20th, we revised the report and prepared it for DHH to use in presentation to the Louisiana Obesity Task Force on March 10th for final recommendations to the legislature and the Senate and House Health and Welfare committees to aid in possible legislation regarding the prevention and treatment of obesity in the state.

i. Executive Summary

Introduction:

Obesity results when susceptible (i.e. genetically pre-disposed) individuals are placed in “adverse” environments. Three critical periods for the development of obesity have been identified. These include: 1) the intrauterine environment or early infancy, 2) 5-7 years of age (adiposity rebound), and 3) adolescence. Many researchers propose that weight and adiposity are entrained during early life and that often the obesity observed in adulthood originates during the early childhood years.

THE NUMBER OF OVERWEIGHT CHILDREN IN THE U.S. HAS REACHED EPIDEMIC PROPORTIONS. APPROXIMATELY 11-15 % OF U.S. CHILDREN ARE CONSIDERED OVERWEIGHT OR OBESE.



IN LOCAL STUDIES, 31% OF AFRICAN AMERICAN SCHOOL-AGED CHILDREN IN NEW ORLEANS WERE OVERWEIGHT, MORE THAN TWICE THE NATIONAL AVERAGE.

There are several environmental factors that contribute to obesity. Low physical activity, high calorie, high fat foods and, a resulting lowered exercise tolerance are some of many factors involved in the development of the disease. However, in young children under 6 years of age, the most important of these factors is parental obesity.

It is well accepted that the environment of the family plays a key role in the development of obesity in young children at risk for adult obesity and related diseases such as diabetes. Research shows that parent inactivity strongly predicts child inactivity. Moreover, the exercise patterns of parents have a strong influence on the frequency of exercise in their children. Research also shows that parental influences are early determinants of food attitudes and practices in young children. And, furthermore, food preferences greatly influence the consumption patterns of young children. Therefore, strategies that positively alter the behaviors and environment of the family may reduce the risk of obesity and diabetes by improving physical activity and nutrition. This may prevent the onset of pediatric obesity and the risk of metabolic disease later in life, especially in those children with primary risk factors.

***EFFORTS TO HALT AND REVERSE OBESITY AND RELATED METABOLIC DISEASE,
THEREFORE, SHOULD BEGIN WITH YOUNG CHILDREN.***

- Educational interventions that target the parents of children at risk for obesity should be an integral part of standard pediatric and family medical care.
- Educational interventions that provide early parent education concerning the risk factors for obesity, appropriate nutrition and physical activity for developing children are needed.
- Education should occur at all levels: doctor's offices, hospitals, corporations, workplace, school and community organizations, and mass media campaigns.
- Children spend approximately 50% of their waking hours in school-related activities; the school environment should be a primary target for efforts to educate parents concerning obesity prevention.
- At risk for overweight children and adolescents, 7 years or older, become increasingly more susceptible as they mature. Therefore, appropriate, targeted family-based dietary interventions are recommended to prevent the onset of a clinically obese condition. Cost effective individual and group approaches are available and should be both encouraged and financially supported by the medical community at large.
- Children, 7 years or older, with clinically overweight or obese conditions require more comprehensive, structured and, in severe cases, aggressive dietary approaches. Strict medical supervision is absolutely necessary. Financial support for research is needed to determine the safest and most effective dietary and physical activity strategies for children with more severe conditions of obesity under randomized and controlled conditions over long-term periods.
- More national, state and local funds are needed for programs that work simultaneously to conduct research and provide ongoing interventions to prevent and treat overweight children.

(1) The effectiveness of existing methods for treating or preventing obesity:***Prevention***

Prevention and treatment interventions for childhood obesity primarily promote the replacement of unhealthy eating and exercise behaviors with new healthier behaviors. Reducing television viewing time, increasing sports and leisure physical activity time, avoiding snacking, replacing high sugar beverages with water and regulating meal times are examples of simple measures to reduce the risk of obesity in children. The potential role of prevention through primary care is currently under-rated by the medical community. In one study, it was concluded that frequent medical clinic visits in preschool aged children might reduce the degree of obesity in the patients. A wide variety of interventions to prevent obesity during childhood have been evaluated including:

- Parental programs and family programs
- Community interventions
- School based programs
- Media Campaigns

Parental and Family Prevention Programs

Providing children with the foundations of healthy eating and physical activity are not necessarily intuitive for parents. For example, many parents believe that they are doing the best thing for their children when they encourage them to eat all of the food on their plate, when they reward them with dessert for eating their vegetables, and when they offer them “treats” as a way of granting them praise. Many parents are unaware that research has demonstrated these traditional patterns can create significant problems for their children. Such interference with the child’s normal appetite mechanisms will undermine their ability to know when they are hungry and when they have eaten sufficient food. Likewise, restricting children’s food intake can undermine good eating habits. When food intake is carefully controlled by their parents, children lose the ability to respond to their own appetite mechanisms and are more likely to overeat when abundant amounts of food are available. Armed with good information, parents who learn appropriate feeding strategies can positively influence their children’s attitudes towards food, food behavior and ultimately, their health and well-being.

- Studies illustrate that by the time children enter kindergarten their food preferences and the social context with which they associate foods are already established. Therefore, educating the families of young children concerning nutrition may have a powerful, positive impact on the obesity risk of those children, especially those with obese parents.
- Research also supports portion control strategies, such as altering nutrition labels on marketplace items and enforcing single serving packaging, to promote decreased caloric intake and a reduction in the prevalence of obesity in youth.
- Research supports that increasing fruits and vegetable consumption is associated with reduced weight status in children.

Similarly, parents need information and support to foster healthy physical activity patterns in their children. Sedentary behaviors such as TV-watching and computer games are now common fare in most American homes. When children slow down, weight gain speeds up. The physical repercussions are not easy to recognize except when overweight children exert their bodies during active playtime. Kids who become overweight are reluctant to undertake physical activity and a vicious cycle begins. Preventing the cycle is more likely to reduce obesity in children. Increasing physical activities does not, however, automatically assume increased structured exercise. Well-meaning parents may mistakenly assume that large bouts of vigorous exercise may provide the best defense against obesity in their young children. What they fail to realize is that young children are inherently physically active and will be physically active if given encouragement and opportunity. If parents can provide opportunities for their children to engage in frequent bouts of non-structured physical activity throughout childhood, they may help to prevent the onset of obesity, especially in those most at risk. Likewise, if they ensure a positive experience when participating in physical activity, their children are more likely to continue being active throughout adulthood.

- Research supports the concept that for many children increasing physical activity may be adequate to prevent the onset of childhood obesity.
- Educational studies indicate that physical fitness improves students' self-image and promotes a positive school environment.
- Moreover, students who are physically fit are shown to be absent less often and illustrate higher academic achievement than non-fit students.

Community interventions

A community-based intervention has been more broadly defined as one that “. . . combines organizing the community and involving citizens with strategies of lifestyle, policy, and/or environmental interventions . . . [and brings] together multiple networks of public and private organizations and special interest groups to channel and coordinate their resources in a range of interpersonal, group, and mass communication strategies”. Several comprehensive community interventions fitting this description have been evaluated. Most were designed to reduce cardiovascular or diabetes disease risk and focused on adults rather than children.

Examples include:

- The Heart to Heart Project the Minnesota Heart Health Program
- The Pawtucket Heart Health Program
- The Health for your Heart project
- The Sandy Lake Health and Diabetes Project
- The Stanford Five-City Project and the
- Stanford Three Community Study

Several other community-based studies have recently been completed or are currently underway which have failed to include weight status measures including:

- CardioVision 2002 in Minnesota and the 5 state overweight intervention program,
- FitWIC, designed for children participating in the Supplemental Feeding Program for Women, Infants and Children.

Several community-based interventions aimed at youth which include a measure of weight status are currently planned or in progress. For example

- The Kahnawake Schools Diabetes Prevention Project is an 8-year intervention that targets a small community of approximately 7,000 Mohawk people near Montreal, Canada.
- One pilot study organizes school and community coalitions to facilitate environmental changes that will increase walking and biking to school among youth in Chapel Hill, North Carolina;
- One pilot study targets preschool children in the childcare setting and involves social marketing and collaboration with community organizations and food establishments in a rural New York community.

Unfortunately, final outcome data of these interventions have not yet been published. Additional community-based interventions must be conducted before the efficacy of these approaches for weight maintenance and overweight prevention in youth can be determined.

School based Programs:

Many of the prevention of obesity studies include a school-based intervention that evaluated a combination of nutrition and exercise strategies. The results of such studies are mixed. In several studies, the interventions successfully prevented an increase in BMI in primarily female students and increased physical activity and nutrition knowledge in both genders. In addition, many published school-based intervention studies did not evaluate weight gain as a primary variable of interest and were designed primarily to observe changes in cardiovascular or health, nutritional intake and/or knowledge or physical activity patterns. Regardless, many of these studies illustrated positive changes in weight status and body composition. Therefore,

SCHOOL ENVIRONMENTS THAT OFFER HEALTHY FOOD CHOICES AND INCREASED OPPORTUNITIES FOR PHYSICAL ACTIVITY SHOULD BE PROMOTED.

This may include initiatives to remove vending machines that offer large-portion, unhealthy snacks and the discouragement of providing unhealthy food (pizza party, donut day, etc.) as rewards for good behavior or academic accomplishment. Recently public officials from Philadelphia, Pennsylvania passed a law prohibiting vending machines in public schools. In the January, 2004 issue of Pediatrics, the American Academy of Pediatrics published this statement concerning soft drinks in schools ¹.

Soft Drinks in Schools: A Statement from the American Academy of Pediatrics Committee on School Health.

This statement is intended to inform pediatricians and other health care professionals, parents, superintendents, and school board members about nutritional concerns regarding soft drink consumption in schools. Potential health problems associated with high intake of sweetened drinks are 1) overweight or obesity attributable to additional calories in the diet; 2) displacement of milk consumption, resulting in calcium deficiency with an attendant risk of osteoporosis and fractures; and 3) dental caries and potential enamel erosion. Contracts with school districts for exclusive soft drink rights encourage

consumption directly and indirectly. School officials and parents need to become well informed about the health implications of vended drinks in school before making a decision about student access to them. A clearly defined, district-wide policy that restricts the sale of soft drinks will safeguard against health problems as a result of over-consumption.

The new Louisiana state policy that requires daily physical education class should be enforced.

- Classes should include at least 30-60 minutes of moderate activity 5 times per week and 20 minutes of vigorous activity at least 3 times per week (Healthy People 2010).
- Classes should include strength, fun and entertaining aerobic activities (including sports and dance) and flexibility exercise.
- Schools should offer increased opportunities to engage in free or unstructured play in younger children during the school day—at least 15 minutes of recess in the morning, 30 minutes at lunch and 15 minutes in the afternoon to allow adequate opportunity to engage in moderate to vigorous physical activity.

School-based studies targeting the parents with educational programs to reduce TV watching and computer games are also shown to be effective at significantly reducing the BMI of children.

THE SCHOOL ENVIRONMENT SHOULD BE A PRIMARY TARGET FOR EFFORTS TO EDUCATE PARENTS CONCERNING THE REDUCTION OF SEDENTARY BEHAVIORS AT HOME SUCH AS TV AND COMPUTER GAMES.

Schools should be encouraged and provided resources to:

- Integrate proven obesity prevention, school-based programs into the school curriculum to provide ongoing opportunities for school children to engage in and learn about healthy eating and physical activity (Planet Health, Catch, etc.)
- Promote school-initiated programs that encourage parents to limit TV-watching, computer games and promote family physical activity (Robinson, et al, Pathways, Hip Teens, Wise Mind, Trim Kids, TAAG, etc)

Media Campaigns

A program entitled "Fighting Fat, Fighting Fit", which used the mass media to target obesity in the United Kingdom was recently evaluated. A total of 3661 respondents completed baseline questionnaires and 2112 (58%) participated in a follow-up evaluation at the end of the 6-month campaign. The participants, who were primarily overweight or obese women, reported significant reductions in weight, and in fat and snack intake, and significant increases in exercise levels, and in fruit, vegetable and starch intake. Results of this study illustrate that mass-media campaigns may promote positive behavior patterns at population level in specific subgroups.

Summary of Prevention Approaches

By utilizing selective prevention measures it is hoped that successful prevention of obesity in young children is feasible. Unfortunately, to date, there are few controlled trials that have successfully illustrated prevention of obesity in non-obese children. More prospective research is needed in order to identify effective strategies for preventing obesity in young children. Controlled trials are required to examine the impact of family-based educational interventions on young children at risk for obesity. This is especially true in minority and low-income populations. The prevention of future chronic disease in children and adults may be dependent on our ability to prevent the onset of obesity in young children. Prevention of obesity in young children should be a primary goal of pediatricians and family health care professionals.

Treatment

The primary goal for the treatment of childhood obesity is healthy eating and increasing daily physical activity. However, the presence of medical complications, age and obesity level should be considered when developing a treatment plan using targeted reductions in high calorie, high fat foods along with exercise and behavior modification. Although successful weight loss is rare in overweight adults,

RESEARCH INDICATES THAT WEIGHT LOSS DURING CHILDHOOD CAN BE MAINTAINED INTO ADULTHOOD.

Reducing the body mass index of overweight children of all ages has been shown to result in an improvement of chronic disease risk factors later during adulthood.

THE LONG-TERM HEALTH BENEFITS OF FAMILY-BASED WEIGHT MANAGEMENT PROGRAMS IN A CLINICAL ENVIRONMENT ARE WELL ESTABLISHED IN 9-12 YEAR OLD OVERWEIGHT CHILDREN.

- Benefits in lipid profiles and body composition have been documented in these children 10 years later during adulthood in several studies.
- Targeting parents with intervention efforts is shown to be effective in short term and long term studies.
- Family behavioral counseling is shown to be an effective method for changing eating and activity patterns in overweight children in clinical settings.
- Recent research advocates parent limit setting techniques to enhance intervention programs to reduce overweight conditions in youth.
- One recent study demonstrated that individual counseling in nutrition and physical activity was superior to standard care in overweight adolescents.

THERE ARE FEW LONG-TERM STUDIES IN ADOLESCENT YOUTH >12 YEARS OF AGE.

Most short term studies in youth >12 years indicate that group behavioral approaches using dietary and physical activity approaches individualized to the age, medical and family history, current level of overweight, physical activity level, and diet history are most effective. More prospective research is needed in order to identify effective nutrition strategies for treating overweight children especially in minority and low-income populations.

- Research suggests that short-term weight loss in youth >12 years can be achieved with a variety of different dietary approaches. Available diets include:
 - The Traffic Light Diet
 - Balanced Hypo caloric Diet
 - Low Glycemic Load Diet
 - Very Low Calorie Diets:
 - Low carbohydrate;
 - Protein modified fast
- Long term randomized controlled trials are needed to examine the contribution of alternative dietary approaches to weight maintenance in adolescents.

- Based on the limited scientific information available, an appropriate exercise intervention for overweight children should include realistic methods for increasing energy expenditure through motivational incentive sessions and educational techniques.
- Initially the intensity of exercise should be moderate or $<55\%$ VO_2 max. This will allow sustained durations of intermittent exercise adequate to promote a significant caloric deficit and a moderate improvement in physical fitness.
- Exercises for children should follow the guidelines of the American College of Sports Medicine. Younger children, who are naturally active, should be given the opportunity to engage in enjoyable, intermittent exercise of varied intensities and durations with less emphasis on the improvement of aerobic capacity.

CLINICAL PEDIATRIC OBESITY INTERVENTIONS SHOULD BE DELIVERED BY A TEAM OF HEALTH CARE EXPERTS IN A MEDICALLY SUPERVISED, NURTURING AND NON-INTIMIDATING ENVIRONMENT.

- Family behavioral counseling is a vital part of the majority of published studies that show successful results.
- In children, from birth to 6 years, parental education is strongly recommended regardless of the child's current weight condition, especially if the parent(s) are obese.
- Pediatrician and family physician based individual and group programs that utilize quality, clinically proven and scientifically tested approaches should be recommended for children who are at risk or already overweight.

PROGRAMS THAT PROVIDE MEDICAL PROFESSIONALS WITH THE TOOLS NEEDED TO DETERMINE THE CHILD'S RISK FOR DEVELOPING OVERWEIGHT CONDITIONS SHOULD BE AN INTEGRAL PART OF STANDARD CLINICAL CARE.

- Physician based, school-based and community based interventions that provide vital nutrition and physical activity education, including parenting skills, are desperately needed.
- Obesity prevention and treatment programs should be designed to the individual cultural, gender and literacy level of the parents.
- The tendency to provide too much information, too fast should be avoided.

- Educational intervention programs should begin upon the first pregnancy visit to the Ob/Gyn doctor and could follow the same structure as natural childbirth and/or breastfeeding encouragement programs.

AT-RISK FOR OVERWEIGHT CHILDREN AND ADOLESCENTS, 7 YEARS OR OLDER, BECOME INCREASINGLY MORE SUSCEPTIBLE AS THEY MATURE.

- The attitude that the child will “grow into their weight” should be rejected as a myth if the child has one or more risk factor.
- Frequent medical monitoring should be encouraged and financially supported in children that fall in the at-risk category and who have one or more risk factor.
- Appropriate, targeted family-based dietary and physical activity interventions are available (Trim Kids, Healthy Solutions, etc.) and should be both recommended and financially supported by the to prevent the onset of a clinical overweight or obese condition.

CHILDREN, 7 YEARS OR OLDER, WITH CLINICALLY OVERWEIGHT OR OBESE CONDITIONS REQUIRE MORE COMPREHENSIVE, STRUCTURED AND, IN SEVERE CASES, AGGRESSIVE DIETARY APPROACHES.

- Strict medical supervision during caloric restriction is absolutely necessary.
- More research is needed to determine the safest and most effective dietary strategy for children with more severe conditions of obesity under randomized and controlled conditions over long-term periods.
- More national, state and local funds for programs that in combination conduct research and provide ongoing programs to prevent and treat overweight children.

(2) The effectiveness of alternate methods for treating or preventing obesity.

Several researchers have recently suggested that more aggressive treatment methods for overweight children should be considered in order to prevent the low quality of life associated with adult obesity.

SINCE WEIGHT LOSS IN CHILDREN CAN BE MAINTAINED INTO ADULTHOOD, ALTERNATIVE INTERVENTIONS SHOULD BE CONSIDERED.

- Several short-term studies examining the effect of very low calorie diets and low glycemic diets result in significant decreases in weight status and improvement in metabolic profiles with few side effects.
- Long term randomized studies utilizing aggressive dietary approaches are needed to confirm these findings.
- The use of such approaches should be reserved for youth with very severe overweight conditions after all other methods have proved ineffective.
- Physician based, individual counseling program including nutrition and physical activity education was shown to be superior to a standard care approach in overweight teenagers.
- Motivational interviewing, commonly used in substance abuse treatment models, has recently been proposed, tested and recommended for use in individual clinical management and childhood overweight treatment programs.

***THERE ARE SEVERAL ALTERNATE, INNOVATIVE APPROACHES CURRENTLY
BEING IMPLEMENTED AND STUDIED IN THE STATE OF LOUISIANA***

- The Trial of Activity for Adolescent Girls (TAAG) is a collaborative, multi-center research study that focuses on the physical activity of adolescent girls in middle school. The trial is designed to test the effectiveness of a coordinated school and community based intervention to prevent the decline of physical activity in girls in middle school. The local TAAG study site includes Tulane, LSUHSC, UNO and PBRC and is currently in the first of a two-year intervention period and will be completed in the spring of 2006.
- An internet-based therapy called Hip Teens was recently tested in a clinical setting at the PBRC and shown to be superior to standard care in African American adolescent females.
- An environmental study (PBRC) to improve nutrition and increase physical activity in 2nd through 6th graders, called Wise Mind, is currently in its first year of intervention in five local Baton Rouge schools.
- A book designed to be used with a local pediatrician or family physician targeting the parents of overweight children, called Trim Kids, (Harper Collins, 2001), was recently published by researchers from LSUHSC and the PBRC.

- The approach is based on over 18 years of clinical and research experience and is shown to be effective in reducing the weight status and improving the metabolic profile of overweight children in several clinical outcome trials.
- It has been endorsed by several experts in the field and has been featured in major scientific publications and national media. Trim Kids is currently being utilized in several physician offices, hospitals, recreation centers and medical centers nationwide and continues to be used in treatment programs at the LSUHSC and PBRC.
- Currently it is being implemented in over 30 school based health centers in the state of Louisiana (Educational training was provided free of charge by LSUHSC and PBRC faculty. The PBRC and Blue Cross/Blue Shield insurance provided the copies of training materials at no charge. Educational materials valued over \$25,000.00 were donated by officers of Committed to Kids, LLC).
- The physical activity component described in Trim Kids is currently being implemented in several school-based trials including the NIH funded TAAG and Wise Mind studies.
- Randomized, long term studies are needed to confirm the results of the one-year clinical outcome trials utilizing the Trim Kids and Committed to Kids approach.
- The Trim Kids (Committed to Kids) program was featured in a Louisiana Public Broadcasting Systems (LA PBS) Documentary entitled, "Kids Trying to Trim Down". The program low to middle class families and presents the nutrition, physical activity and behavioral content in an entertaining, easy-to-understand, visual format. The one-hour documentary has aired statewide, nationally and was nominated for a Peabody Award.
- Due to the overwhelming success of the LA PBS documentary, they are currently filming a 6-part series that details the Trim Kids (Committed to Kids) program exclusively.

RECENTLY, THE CONTRIBUTION OF EARLY NUTRITION TO DEVELOPING FETUSES AND INFANTS HAS TAKEN CENTER STAGE IN EFFORTS TO PREVENT THE EARLY ONSET OF OBESITY.

Recent evidence implicates slow fetal growth and low birth weight as risk factors for several adult chronic diseases including obesity and diabetes. In addition, although not conclusive,

there is emerging research suggesting that excessive weight gain prior to and during pregnancy is associated with metabolic disease in the offspring, even in the absence of maternal diabetes. During pregnancy expectant mothers are provided with some information on the importance of maintaining a healthy weight, but this information is not specific to the increased obesity risk implied to the baby. Thus, Ob Gyn health care professionals may be well positioned to provide valuable, vital information that may have a dramatic impact on reducing the current worldwide obesity epidemic. To date, early maternal counseling to reduce the risk of obesity and metabolic disease in the offspring has not been implemented or evaluated.

- Information concerning the early risk for obesity and related chronic disease was recently provided to pediatricians by a member of the baby food industry. A sample of this information is below (see Appendix for full article Pediatric Basics: The Impact of Early Nutrition on Adult Health and Risk for Disease: *Putting Research Into Practice*, September, 2003)

Putting Research Into Practice by Melinda S. Sothern, PhD

Adult obesity more often than not originates in early childhood, with full-term low birth weight infants (less than 5.5 lbs.) at greatest risk. As such, pediatricians need to caution parents of these vulnerable children about the negative impact of rapid weight gain during the first few years of life and encourage frequent medical monitoring to reduce the risk of obesity and related chronic disease during later childhood and beyond....Pediatricians can help parents break the unhealthy patterns that predispose their young children by guiding them to make changes in the home environment that promote healthy eating and increased physical activity. But it won't happen overnight Change must come gradually for parents experience success. Establishing just one nutrition and physical activity goal per pediatric visit can go a long way to creating a nutritious, physically active home environment. Here's an example:

Infant Visit

Nutrition Goal: learn to respect baby's innate feeding cues.

Strategies:

1. Breastfeed exclusively if possible.
2. Let baby's appetite determine what and how much to avoid over or underfeeding.

Physical Activity Goal: Make physical activity a natural part of everyday.

Strategies:

1. Set aside time each day for unstructured play during "floor time".
2. Explore the outdoors together during walks and bike rides.

- Programs are being developed that target pregnant women with a family history of obesity in efforts to both prevent excessive weight gain during pregnancy and improve nutritional intake. Funding for these programs is needed.
- Programs to encourage breastfeeding as a protective method are also encouraged.
- Efforts are also underway to encourage healthy eating and increased physical activity in children whose mothers use the WIC programs. The results of such efforts, however, remain preliminary.

THERE HAVE BEEN ONLY A LIMITED NUMBER OF TRIALS EXPLORING THE USE OF PHARMOCOTHERAPY IN PEDIATRIC OBESITY TREATMENT.

- In one study, researchers observed a synergistic effect of adding sibutramine to a multi-disciplinary behavioral weight loss treatment intervention in adolescents over a one-year period.
- More research is needed in overweight children and adolescents before pharmacotherapy can be widely accepted and utilized.

(3) The fiscal impact of treating or preventing obesity.

Costs of diseases associated with obesity, including diabetes mellitus, hypertension, heart disease, stroke, gout, arthritis and cancer exceed 100 billion dollars per year in the U.S., about 8% of the national health care budget.

THE ECONOMIC BURDEN OF OBESITY-ASSOCIATED ILLNESS DURING CHILDHOOD HAS INCREASED BY 43% (35 TO 127 MILLION) IN THE PAST 2 DECADES.

- The cost to treat overweight children in a clinical setting ranges from \$1,200 to 11,000 per year. Group treatment programs are shown to be more cost-effective than mixed (individual plus group) therapy.
- In a recent study, the use of a school-based nutrition and physical activity intervention, Planet Health, was shown to be equally as effective and significantly less expensive than the cost associated with treating overweight children.
- More research is needed to determine the long-term fiscal impact of preventing adult obesity by targeting overweight children and adolescents with clinical treatment programs.

4) The compliance and cooperation of patients with various methods of treating or preventing obesity.

With few exceptions the compliance and cooperation of overweight children enrolled in medical treatment programs is adequate to promote a positive health outcome.

- Retention rates range from 60-90% and participations rates are typically greater than 50%.

- Few studies, however, are successful in reporting the long term (> 2 years) outcome of their treatment interventions with follow up rates averaging as low as 13% in some trials and only four studies reporting >80% follow-up in younger children.
- Studies are needed that examine the long-term compliance and acceptance rates of obesity treatment programs for children especially in adolescents with severe overweight conditions.

(5) The reduction in serious medical problems associated with diabetes that results from treating or preventing obesity.

Several school-based prevention trials illustrate favorable alterations in components of the metabolic profile of youth. Only two long-term (>2 years) and eight short-term studies illustrate improvements in the metabolic profiles of overweight children. All utilized a multi-disciplinary approach including a variety of dietary approaches, exercise programs and family behavior modification.

***IMPROVEMENTS IN THE METABOLIC PROFILES OF
OVERWEIGHT CHILDREN INCLUDE REDUCTIONS IN PLASMA INSULIN LEVELS,
TOTAL AND LDL CHOLESTEROL. TOTAL AND VISCERAL FAT***

- One recent study reported significant differences in insulin resistance as measured by a homeostasis model in overweight teens consuming a low glycemic load versus a low fat, balanced diet.
- There are no studies examining the contribution of prevention and treatment programs to the reduction of medical complications in overweight children with type 2 diabetes.
- More long term, prospective research is needed to examine the contribution of overweight treatment and prevention programs to an improved diabetes risk profile in children.

Conclusion

***ACCORDING TO A RECENT POSITION PAPER PUBLISHED BY THE AMERICAN
ACADEMY OF PEDIATRICS:***

- Prevalence of overweight and its significant co morbidities in pediatric populations has rapidly increased and reached epidemic proportions.
- Prevention of overweight is critical, because long-term outcome data for successful treatment approaches are limited.
- Genetic, environmental, or combinations of risk factors predisposing children to obesity can and should be identified.
- Early recognition of excessive weight gain relative to linear growth should become routine in pediatric ambulatory care settings. BMI (kg/m^2 [see <http://www.cdc.gov/growthcharts>]) should be calculated and plotted periodically.
- Families should be educated and empowered through anticipatory guidance to recognize the impact they have on their children's development of lifelong habits of physical activity and nutritious eating.
- Dietary practices should be fostered that encourage moderation rather than over consumption, emphasizing healthful choices rather than restrictive eating patterns.
- Regular physical activity should be consciously promoted, prioritized, and protected within families, schools, and communities.
- Optimal approaches to prevention need to combine dietary and physical activity interventions.
- Advocacy is needed in the areas of physical activity and food policy for children; research into pathophysiology, risk factors, and early recognition and management of overweight and obesity; and improved insurance coverage and third-party reimbursement for obesity care.

The current childhood overweight epidemic is not the fault or the responsibility of any one single sector of society. All must work together to develop strategies to change public opinion and behavior concerning healthy nutrition and physical activity across the life span. There are five major target areas that can be identified: 1) Family and home environment, 2) Public educators, administrators and school environment, 3) Health care, 4) Public policy, and 5) Public awareness. Each area offers a unique opportunity to develop and promote effective methods and provide resources for the prevention and treatment of overweight children (Table 1). A commitment on the part of one, two or three areas without the complete support of the others will only sabotage efforts. Only when all five areas *collectively* commit to providing the necessary resources will we realize a shift in this growing epidemic of childhood obesity (Table 1).

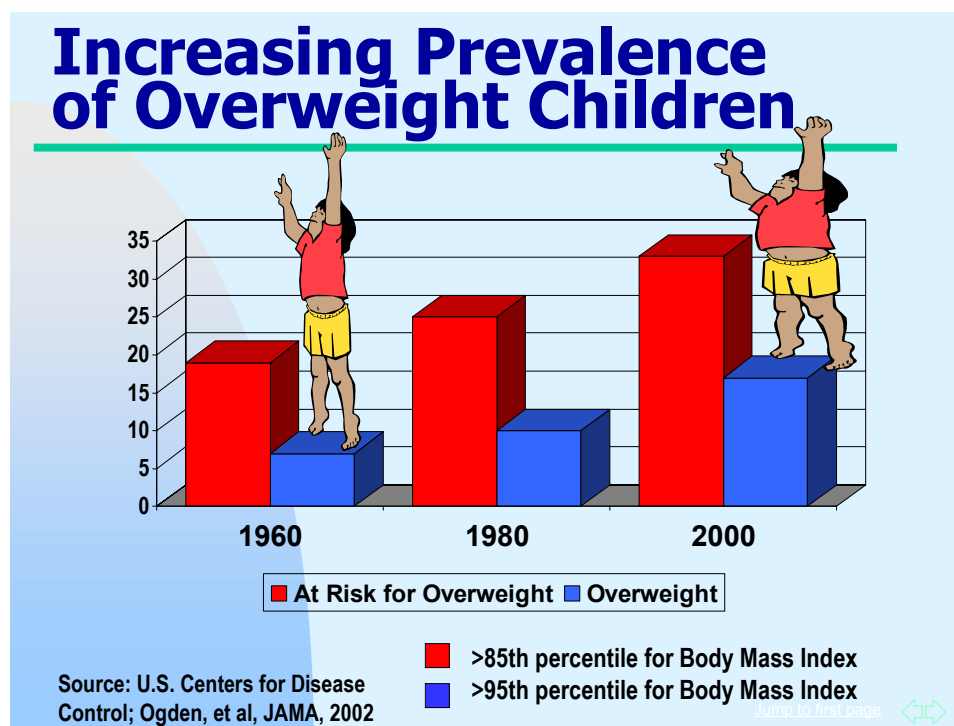
Table 1: Target Areas - Prevention and Treatment of Overweight Children	
1. Family and Home environment	
a. Parental education and awareness	
b. Neighborhood safety	
2. Public Educators, Administrators and School environment	
a. Cafeteria environment	
b. Physical education environment	
c. Classroom environment	
d. After school and recess environment	
e. Non-food incentives for academic achievement and positive behavior	
3. Health care	
a. Ob/Gyn doctors	
i. Patient education	
ii. Monitoring of high-risk populations	
iii. Referral system	
b. Pediatrician, Family Physician, Dieticians, Psychologists, Exercise and related health care professionals	
i. Patient education	
ii. Monitoring of high-risk populations	
iii. Referral system	
iv. Prevention programs	
v. Treatment programs	
vi. Maintenance/Relapse prevention programs	
4. Public policy	
a. Insurance and governmental reimbursement for medical evaluation, monitoring prevention, treatment and maintenance programs	
b. Food labeling and packaging (portion control)	
c. School nutrition and physical activity policy	
i. Vending machine policy	
ii. Daily, unstructured physical activity periods (recess) and physical education class.	

iii. Limits on homework
iv. Federal and state grants or other funds to schools that promote and maintain a healthy school environment
d. Worksite policy (flex time, home offices, family and medical leave)
e. Youth media and marketing
f. Increased funding for childhood overweight research
5. Public awareness
a. Community programs
b. Promotions and Social Marketing Campaigns

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I. Introduction: Statement of Problem of Childhood Overweight Nationally and in Louisiana

The increasing prevalence of childhood obesity is a worldwide health concern. The number of overweight children in the U.S. has reached epidemic proportions. The prevalence of obesity in children and adolescents is higher than 20 years ago in all ethnic, age, and gender groups^{2 3 4}. Currently over 10 million children in the U.S. are at risk for overweight. Over 11 percent of these children are considered overweight or obese, defined as greater than the 95th percentile for age and height (U.S. Centers for Disease Control Body Mass Index Percentiles)⁵, and children are becoming obese at younger ages.



The prevalence of obesity in teenagers has tripled in the past 40 years. The escalating rates of adolescent obesity will impact the future health of Americans³. Adolescent obesity, which often originates during the early childhood years, is persistent and difficult to manage. Eighty percent of overweight 10-15 year olds will become obese adults if successful interventions are not developed³. The increase in the prevalence of obesity is well documented in male and female adolescents and in those from all ethnic backgrounds⁶.

According to the U.S. Surgeon General:

- In 1999, 13% of children aged 6 to 11 years and 14% of adolescents aged 12 to 19 years in the United States were overweight. This prevalence has nearly tripled for adolescents in the past 2 decades.
- Risk factors for heart disease, such as high cholesterol and high blood pressure, occur with increased frequency in overweight children and adolescents compared to children with a healthy weight.
- Type 2 diabetes, previously considered an adult disease, has increased dramatically in children and adolescents. Overweight and obesity are closely linked to type 2 diabetes.
- Overweight adolescents have a 70% chance of becoming overweight or obese adults. This increases to 80% if one or more parent is overweight or obese. Overweight or obese adults are at risk for a number of health problems including heart disease, type 2 diabetes, high blood pressure, and some forms of cancer.
- The most immediate consequence of overweight as perceived by the children themselves is social discrimination. This is associated with poor self-esteem and depression.

Problem of Overweight in Louisiana

The PBRC has conducted studies demonstrating the availability of a local target population for ongoing childhood obesity research. The study conducted in 140 Baton Rouge school children, 12-14 years of age, documented that more than 50 percent of these children have a BMI in the top 15th percentile, according to U.S. normative data ⁷. The national average is approximately 28-30% ³. Furthermore, in African-American school-aged children in New Orleans, LA the overall prevalence of obesity (>95th BMI US CDC) ⁵ is 33% which is more than twice the national average of 11-15% ⁸.

We evaluated the prevalence of obesity in school-aged children from New Orleans, La., USA. Height (cm) and weight (kg) were obtained, and BMI calculated from 819 children (Males = 369, Female = 450; African-American = 689, Caucasian = 89, Hispanic = 23, Asian = 18) ages 6-14 years from four elementary schools located within the city of New Orleans. The results are shown below.

Mean Age (yrs)	N= all subjects	BMI > 95 th (mean ± SD)	N > 95 th BMI	% > 95 th BMI
6	123	20.5±3.6	53	43%
7	125	22.4±3.5	44	35%
8	98	24.8±3.8	28	29%
9	111	24.6±2.7	31	28%
10	116	26.6±3.2	35	30%
11	89	28.5±3.7	27	30%
12	79	31.4±3.8	15	19%
13	67	30.9±3.1	17	25%
14	11	29.6±2.7	2	18%

The results indicate that there is an overall obesity prevalence of 31% (Range: 18%- 43%). This preliminary investigation indicates that New Orleans school-aged children are more than double the national average for pediatric obesity.

Researchers from the LSU Pennington Biomedical Research Center evaluated the diagnosis and referral rate of obese children who were seen by local pediatricians in Lafayette, Louisiana. Three primary care offices were included in the analysis. A total of 1051 patient charts were randomly selected for review. The results were as follows ⁹:

Table No. 1: Patients Diagnosed and Referred for Treatment

	Dr. Faugot	Dr. Atwi	Melancon
Total number of patients	552	205	294
Total number obese	69	30	30
Percent Obese	12.5%	14.83%	10.20%
Total number diagnosed with obesity	19	12	0

Percent diagnosed	27.54%	40.00%	0%
Total number referred for obesity treatment	6	2	0
Percent referred for treatment	8.70%	16.67%	0.00%

Table No. 2: Treatment Referrals

Treatment Type	Pharmaceutical	Diet	Exercise	General Counseling
	1	3	2	2

Health Problems Related to Obesity

Pediatric obesity is a serious chronic disease that contributes to various conditions such as hypertension, hypercholesterolemia, diabetes, and to an increased incidence of musculoskeletal injuries ¹⁰. The metabolic consequences of obesity even in moderate conditions include atherogenic dyslipidemia, glucose intolerance and coagulation system abnormalities ¹⁰. Furthermore, obese children are at an increased risk for future cardiovascular disease ¹¹.

Recent investigations have explored the relationship of total body fat, abdominal obesity, cardiovascular disease risk factors and insulin resistance in young children ^{12, 13}. There appears to be sufficient evidence to suggest that early onset obesity promotes metabolic disorders that lead to insulin resistance, hyperlipidemia and related chronic disease during adulthood, especially in at-risk youth. Obese children often display elevated total cholesterol (TC), low density lipoproteins (LDL), total body and abdominal fat and reduced high density lipoproteins (HDL) ¹⁴⁻¹⁶. Recently, fatty streaks were found in the arteries of children as young as 13 years of age ¹⁷. The relationship between coronary artery disease (CAD) and type 2 diabetes is well established; their roles in metabolic disease clearly evident. Therefore, in children with early signs of CAD, especially in those who are obese, the risk of developing type 2 diabetes is even

greater. Hullman¹⁸ and Vanhalla¹⁹ have both published results that implicate obesity in childhood with metabolic disorders during adulthood. In children with obese parents and a family history of diabetes the risk for developing obesity and diabetes is far greater. These at-risk children may be predisposed genetically and behaviorally to the early manifestation of subtle, nonsymptomatic metabolic abnormalities working synergistically to create a childhood obesity phenotype for chronic disease²⁰. Thus, in at-risk children, the metabolic disorders that promote chronic diseases, such as diabetes, most likely originate early in childhood^{17, 20-22}, perhaps earlier than originally proposed or defined by the limited technology available.

Childhood obesity promotes advanced maturation in especially severe condition²³. Obese children have advanced bone age, higher bone density and area and increased sexual hormone levels²⁴. Increased estradiol levels have been associated with obesity in adult females²⁵. Precocious puberty²⁶ or premature pubarche^{27, 28} were recently associated with insulin resistance^{27, 29}, long term changes in body composition increases in IGF1^{26, 30}, exaggerated adrenal response and polycystic ovary syndrome³¹. Metabolic defects resulting from parental (environmental and genetic) influences and early onset obesity may promote hormonal alterations that predispose obese children to advanced maturation. Thus, biological mechanisms that promote obesity during childhood may also play a role in premature maturation.

Research conducted in European, Canadian and South American populations suggests that obese adolescents, matched for age, display advanced maturation and increased bone mineral density (BMD), bone mineral content (BMC), bone area (BA), lean body mass (LBM) and fat body mass (FBM) when compared to normal weight controls³².

Excess body weight and hormonal imbalance have been associated with growth (iphiphysis) plate injuries in obese pubertal youth³³. During weight bearing exercise, obese children carry an additional load that creates additional stress to the growth plates. There is also a strong endocrine base for slipped capital femoral epiphysis³³. Growth hormone reduces plate strength while sex hormones promote plate closure and, therefore, improved strength³³. Estrogen and growth hormone must be in balance for normal growth plate development to occur. When imbalances occur, the resulting bone abnormalities reduce physical activity, increase obesity and further enhance the risks for adult obesity and diabetes. The relationship of hormonal

maturation parameters to obesity and insulin resistance in children is an area in need of further research.

Current research indicates that the most serious and prevalent long-term consequence of childhood obesity is psychosocial³. Obese children may experience adverse psychological consequences of childhood obesity including lowered self-esteem and increased depression ratings^{3, 34}. Obese children are targets of early and systematic discrimination by peers, family members and teachers. Moreover, the early maturation associated with childhood obesity is linked to low self-esteem³. In a recent study, Schwimmer and colleagues³⁵ demonstrated that the self-reported quality of life of severely overweight children was five times lower than normal weight children and, more astonishing, equal to that of children with terminal cancer.

Impaired Health-Related Quality of Life for Severely Overweight Children and Adolescents vs Healthy and Cancer Samples		
Child self-report total score		
Odds Ratio	Obese vs Healthy	Obese vs Cancer
Physical health score	5.0 (3.4-8.7)	1.0 (0.6-1.7)
Social Functioning	5.3 (3.4-8.5)	1.8 (1.0-3.1)
School Functioning	4.0 (2.4-6.5)	1.1 (0.6-2.0)

Schwimmer, et al, JAMA, 2003

Impaired Health-Related Quality of Life for Severely Overweight Children

(Schwimmer, et al, JAMA, 2003)

- Severely overweight children were 5 times more likely than healthy children to have impaired physical functioning.

- Doll et al reported that physical functioning decreased with increasing weight among adults.
- The BMI z score among severely overweight children was inversely correlated with physical functioning.
- The diminished ability to move with increasing weight leads to a decrease in caloric expenditure, a further mismatch in energy balance leading to additional weight gain – a vicious cycle.

The impact of excess weight on the ability to exercise is best measured by examining the physiologic function of children under laboratory conditions. Physiologic function is the cardio-respiratory response to exercise stress, which is evaluated by obtaining physiologic and metabolic values during periods of rest, sub maximal work or during maximal effort ³⁶. Exercise training improves physiologic function by improving the oxygen transport system, the function of the central nervous system, by increasing functional stability and perhaps through enhancement of the immune system ³⁷. Studies indicate that exercise responses change as subjects mature; therefore, younger subjects will exhibit a different heart rate, ventilation, and oxygen uptake (VO_2) response to varying workloads than older subjects ³⁸. Resting, sub maximal and peak exercise heart rates differ with respect to age, body size and physical conditioning ³⁹. Maximal oxygen consumption (L/min) increases with age in both male and female children as total body mass increases; however, excess body fat confounds this relationship ^{36, 40}.

Maffeis and others ⁴¹ reported that the metabolic and physiologic responses were significantly lower in 17 nonobese (95% ideal body weight [IBW]) children than in 23 overweight (138%IBW) children during walking and running on a treadmill at different intensities. They concluded that overweight children expended 50% more energy moving their bodies than nonobese subjects ⁴¹. Studies using cycle as opposed to treadmill ergometry have yielded conflicting results. Cooper, et al ⁴² examined the oxygen uptake response during cycle ergometry in a sample of 18 obese children ranging in age from 9-17 years. The obese children had significantly prolonged response kinetics when ventilation parameters were observed. Loftin and colleagues ⁴³ reported no significant differences in VO_2 peak in a group of obese children during cycle (weight-supported) or treadmill (weight-bearing) ergometry. Maffeis and others ⁴⁴ confirmed these findings in a related investigation.

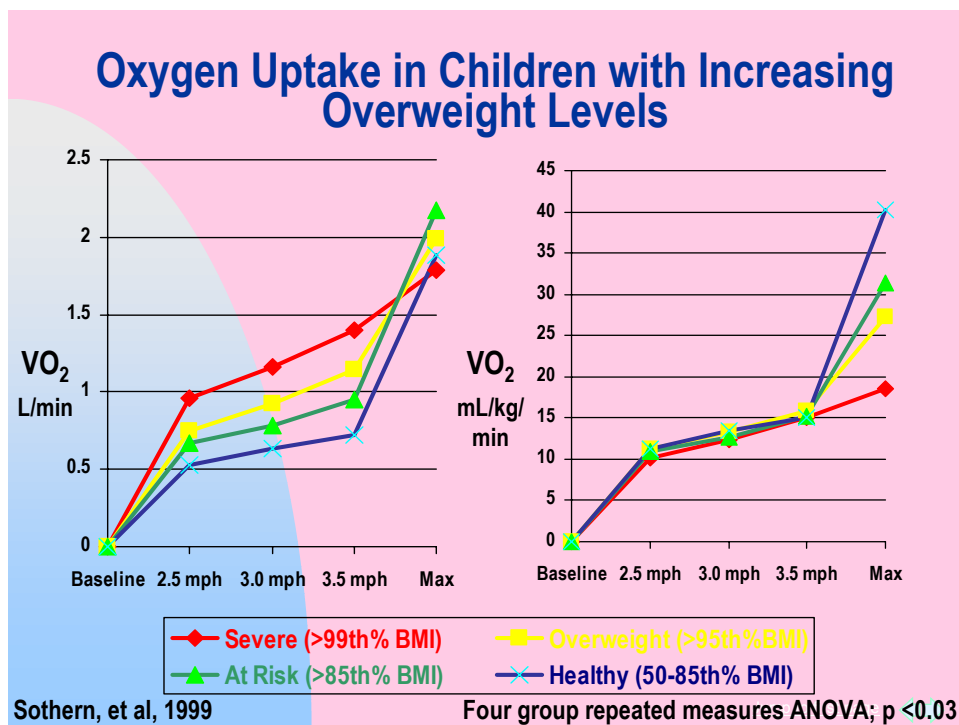
Investigators have noted that body mass is strongly related to absolute VO_2 (L/min.) during sub maximal, non-weight bearing exercise and influences work efficiency during steady state exercise ⁴⁵. In contrast, Bergh and colleagues ⁴⁶ reported that sub maximal and maximal oxygen uptake did not increase in proportion to body mass during running in adults. Housby ⁴⁷ reported aerobic capacity in girls to be positively related to lean body mass and age, but negatively related to weight. However, in male subjects, size was not a significant predictor and aerobic capacity was closely related to age. These results indicate the importance of considering body mass when examining the performance of obese versus nonobese subjects during exercise testing.

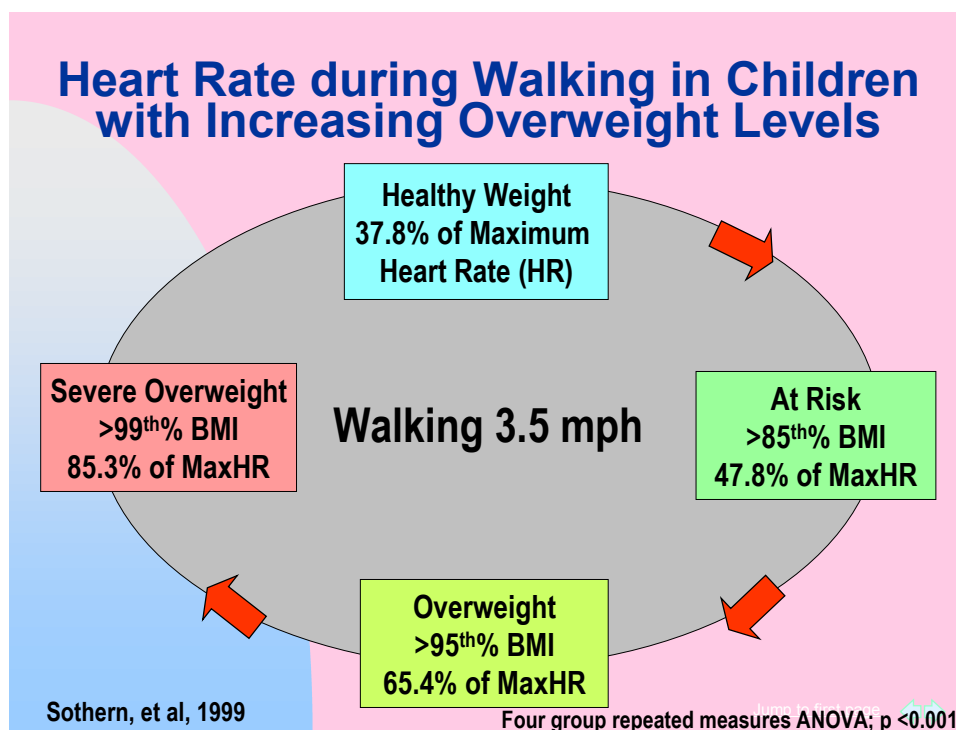
Increasing levels of obesity may decrease exercise performance for the following reasons: 1) less mechanical work is performed to overcome friction between the thighs and between the arms and torso of the overweight individual when walking; 2) pulmonary function is impaired in obese individuals associated with moving a heavier body mass forward. Thus, in obese children, an increased cardiac output and respiratory effort are required to maintain a similar level of work to accommodate the excess load; or 3) during weight-bearing exercise, such as walking, the skeletal musculature is responsible for supporting and moving the entire body mass forward. The increased recruitment of muscle to compensate for the additional fat weight load thereby results in an increased uptake in oxygen. When obese children exercise at sub maximal workloads, excessive body weight induces an excess load that increases the energy required to maintain the same level of exertion as non-obese children ^{36, 41, 48}.

Studies Examining the Health Consequences of Obesity in Childhood in Louisiana:

Researchers at the Louisiana State University Health Sciences Center (LUSHSC) determined the level of obesity that children experience a significantly greater physiologic and metabolic response to weight bearing activity (walking) than non-obese children ^{48, 49}. Thirty-five overweight and 12 normal weight children, between the ages of 7 to 17 years, walked on a treadmill in three 5-minute intervals, 2.5 , 3.0 and 3.5 mph, 0% grade. Treadmill elevation then increased 2% every two minutes until volitional termination. In all measured variables, groups with increasing levels of overweight were differentially affected by the various stages/intensities of exercise. The only exception to this finding was the value for relative VO_2 mL/kg/min. Absolute volume of oxygen consumed (VO_2) was significantly different between the groups at all three workloads but not at maximal effort ($p < 0.001$). At the highest workload, 3.5 mph, normal

weight subjects were exercising at 38% of Max $\dot{V}O_2$, at risk for overweight subjects at 54% of Max $\dot{V}O_2$, overweight subjects at 72% of Max $\dot{V}O_2$ and the severely overweight subjects were exercising at 82% of Max $\dot{V}O_2$ ^{48, 49}. The overweight and severely overweight subjects consistently displayed greater physiologic and metabolic responses for a given level of intensity than the at risk for overweight and normal weight with few exceptions ^{48, 49}.





The results of this study illustrate that 1) the impact of obesity level on physiologic function during weight-bearing activity in obese children may be relative to the intensity of the exercise, and 2) during weight-bearing activity of increasing intensities the disparity between the different levels of obesity may be increased. By determining the level of obesity where significant physiologic and metabolic dysfunction occurs, this study revealed important information that can be used to set appropriate, specific exercise guidelines for obese children.

Causes of Childhood Obesity

According to the U.S. Surgeon General the causes of overweight in children include:

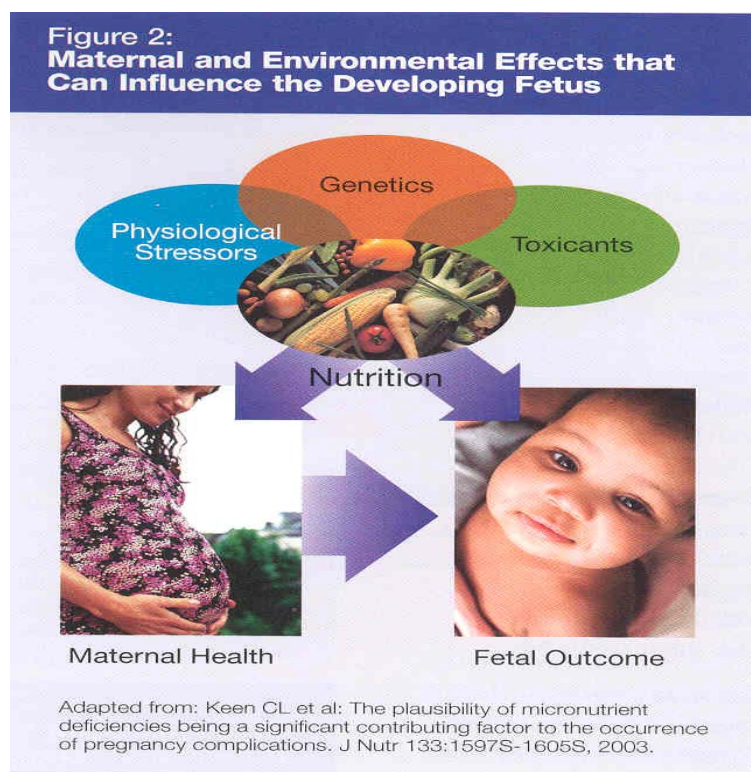
- Overweight in children and adolescents is generally caused by lack of physical activity, unhealthy eating patterns, or a combination of the two, with genetics and lifestyle both playing important roles in determining a child's weight.
- Our society has become very sedentary. Television, computer and video games contribute to children's inactive lifestyles.
- 43% of adolescents watch more than 2 hours of television each day.

- Children, especially girls, become less active as they move through adolescence.

According to the current scientific literature causes of overweight condition in childhood remain unclear. Parental obesity is the single most important predictor of adult obesity in children under the age of six. Genetics plays an important role; but, family environment has the greatest impact on a child's weight condition. The child's own weight condition becomes a stronger predictor of adult obesity as he or she matures. These facts are important when considering dietary options for treating pediatric obesity. In fact, three periods are considered critical opportunities for the development of adult obesity and related metabolic disease: 1) birth, 2) 5-6 years and 3) adolescence. Evidence continues to support reduced physical activity and sedentary behaviors, such as television viewing, as primary causes of the current worldwide obesity epidemic⁵⁰⁻⁵².

The Interaction of Genetics and Environment

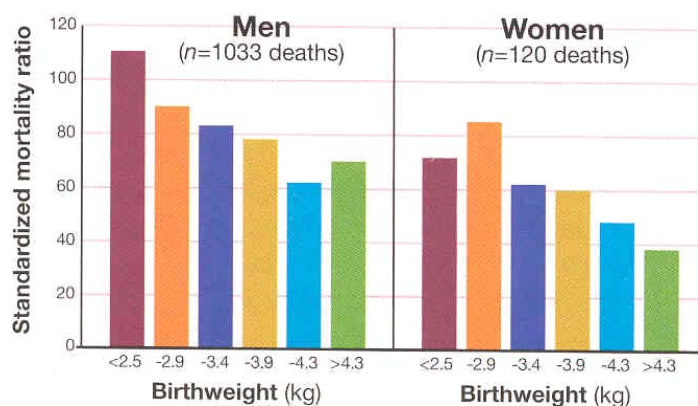
Familial factors strongly impact the development of childhood obesity. Children with two obese parents have an 80% chance of developing obesity during their lifetime^{53, 54}. If only one parent is obese, this risk factor declines to 40%. Remarkably, only 7% of children born to lean parents will develop childhood obesity^{53, 54}. However, it is unclear if these outcomes are based on environmental issues or genetic predisposition⁵⁰. Bouchard⁵⁵ suggests that in most individuals, the human variation in body composition is not associated with genetic predisposition. These individuals may be positively impacted by appropriate clinical and educational interventions. Dietary intake and physical activity are behavioral and, thus, modifiable aspects of the prevention and treatment of childhood and adolescent obesity³. It is clear, that human obesity and metabolic disease are determined by a complex matrix of familial factors including genetics, culture, diet and activity patterns. Research during the last decade has focused on determining environmental conditions that promote obesity and metabolic disease in genetically vulnerable individuals. Current studies seek to identify genetic markers for fatness and altered metabolism. There are strong arguments for the impact of the genetic profile, as well as the early nutritional environment (Figure 2) on the tracking of obesity from birth to adulthood⁵⁶⁻⁵⁸.



The concept of a thrifty genotype was first proposed by Neel⁵⁸ almost 40 years ago. Human populations exposed to nutritional stresses are proposed to have genetically selected thrifty metabolic profiles^{58, 59}. Genotypes with efficient methods of processing a limited food supply, if provided with an unlimited access to high calorie foods, develop obesity and metabolic disease⁶⁰. This concept is most supported if one considers the impact of western dietary habits on the amplification of metabolic disorders due to the thrifty genetic profile, especially in developing populations⁵⁹. Patterns of intrauterine growth are highly associated with obesity and chronic disease later in life⁵⁶. Small size at birth caused by constraints in growth is associated with long-term metabolic and physiologic function⁵⁷. Studies in Pima Indians⁶¹ and in Pacific Island populations⁶² provide support for the genetic origin of the relationship of low birth weight to obesity and metabolic disease later in life. However, Lucas⁶³, and Jackson and others⁵⁶ suggest that there exists a programming response established by the interaction of the infant and their early environment during critical periods. The response establishes an upper limit of metabolic competence or the ability of an individual to cope with metabolic stress. Impaired metabolic competence⁵⁶, when combined with an environment that challenges an individual's ability to cope with this metabolic stress, increases the risk of metabolic and physiologic dysfunction and ultimately chronic disease. Ravellie and colleagues⁶⁴ examined the impact of food deprivation in early and late pregnancy during the Dutch hunger winter of 1944-1945. Adult

obesity was highly correlated to famine during early pregnancy as opposed to late pregnancy. In contrast, Allison ⁶⁵ in a study of 13,000 twin pairs reported that the intrauterine environment significantly impacted adult height independent of weight but not weight independent of height. Other studies indicate that central adiposity may be more highly associated with retarded fetal growth than body weight ⁶⁶⁻⁶⁸. Law ⁶⁶ studied 845 men and determined that increased waist for height ratio was associated with decreased growth during infancy. Studies examining the relationship of birth weight to adult mortality show that males and females with weights <2.5 kg have increased mortality ratio (Figure 1).

**Figure 1:
Fetal Nutrition & Adult Disease**



Godfrey KM, Barker DJP: Fetal nutrition and adult disease. *Am J Clin Nutr* 71 (Suppl): 1344S-52S, 2000.

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Insulin resistance syndrome, which is closely related to central adiposity, has also been associated with low birth tertile in both Caucasians and Hispanics ⁶⁹. The interaction of genetics and early human environment and, its relationship to obesity and metabolic disease continues to be investigated ⁷⁰.

II. Guidelines for Treatment of Overweight in Children

Experts agree that the primary goal for the treatment of pediatric obesity is healthy eating and increased daily physical activity. The Committee on Nutrition of the American Academy of Pediatrics recommends family-based therapy including diet, psychosocial therapy and exercise

for obese children. Furthermore, targeting families of susceptible children with nutrition and lifestyle behavior education may create an added benefit to the other family members⁷¹. However, the presence of medical complications, age and obesity level should be considered when developing treatment plans. More aggressive dietary treatment methods have recently been proposed to prevent the low quality of life associated with adult obesity.

Recommendations from the American Academy of Pediatricians include the following⁷²:

Health supervision

1. Identify and track patients at risk by virtue of family history, birth weight, or socioeconomic, ethnic, cultural, or environmental factors.
2. Calculate and plot BMI once a year in all children and adolescents.
3. Use change in BMI to identify rate of excessive weight gain relative to linear growth.
4. Encourage, support, and protect breastfeeding.
5. Encourage parents and caregivers to promote healthy eating patterns by offering nutritious snacks, such as vegetables and fruits, low-fat dairy foods, and whole grains; encouraging children's autonomy in self-regulation of food intake and setting appropriate limits on choices; and modeling healthy food choices.
6. Routinely promote physical activity, including unstructured play at home, in school, in childcare settings, and throughout the community.
7. Recommend limitation of television and video time to a maximum of 2 hours per day.
8. Recognize and monitor changes in obesity-associated risk factors for adult chronic disease, such as hypertension, dyslipidemia, hyperinsulinemia, impaired glucose tolerance, and symptoms of obstructive sleep apnea syndrome.

A panel of experts convened by the U.S. Centers for Disease Control suggested the following physical activity recommendations, which were later published by Barlow and Dietz⁷³.

Obesity Evaluation and Treatment: Expert Committee

Recommendations to Reduce Calorie Intake:

(Barlow & Dietz, 1998)

- Well-balanced meals and a health approach to eating
- Food guide pyramid
- Elimination of high calorie snacks

- Stoplight diet
- Gradual changes in food preparation to promote family support
- Stay away from adult-focused commercial programs

In a review of the available scientific literature, Sothorn and Gordon ⁷⁴, suggested the following: dietary recommendations for treating pediatric obesity

- Obesity is a chronic disease. Treatment should be life long. When the treatment is withdrawn the patient usually regains the weight lost.
- All treatment programs should be closely supervised by a pediatrician.
- Consult a registered dietician for specific dietary recommendations. Dietary approaches should be specific to the patient's medical history, age and level of obesity. Diets must be accompanied by behavioral counseling and exercise.
- Set short-term, achievable goals
- Re-evaluate the patients' condition every 3-6 months.
- Provide ongoing family nutrition education that promotes replacing non-nutritious foods with healthy alternatives and uses portion control when healthy eating alone is not enough.

The same panel of experts convened by the U.S. Centers for Disease Control suggested the following physical activity recommendations, also later published by Barlow and Dietz ⁷³.

Pediatric Expert Committee Recommendations to Increase Physical Activity:

(Barlow & Dietz, 1998)

- Intervention should begin early in overweight children >3 years.
- Limit TV-watching to <2 hours/day.
- Promote unstructured outdoor play in young children, individual or group sports in older children.
- Incorporate activity into usual daily routines, i.e., walking to school.
- Interventions should be family-based and include parenting skills.

A summary from the American Academy of Pediatrics suggests the following ⁷²:

1. Prevalence of overweight and its significant co morbidities in pediatric populations has rapidly increased and reached epidemic proportions.
2. Prevention of overweight is critical, because long-term outcome data for successful treatment approaches are limited.
3. Genetic, environmental, or combinations of risk factors predisposing children to obesity can and should be identified.
4. Early recognition of excessive weight gain relative to linear growth should become routine in pediatric ambulatory care settings. BMI (kg/m^2 [see <http://www.cdc.gov/growthcharts>]) ⁷⁵ should be calculated and plotted periodically.
5. Families should be educated and empowered through anticipatory guidance to recognize the impact they have on their children's development of lifelong habits of physical activity and nutritious eating.
6. Dietary practices should be fostered that encourage moderation rather than over consumption, emphasizing healthful choices rather than restrictive eating patterns.
7. Regular physical activity should be consciously promoted, prioritized, and protected within families, schools, and communities.
8. Optimal approaches to prevention need to combine dietary and physical activity interventions.
9. Advocacy is needed in the areas of physical activity and food policy for children; research into pathophysiology, risk factors, and early recognition and management of overweight and obesity; and improved insurance coverage and third-party reimbursement for obesity care.

III. Treatment Indicators

According to the U. S. Surgeon General the determination of overweight in children and adolescents should adhere to the following guidelines:

- Doctors and other health care professionals are the best people to determine whether your child or adolescent's weight is healthy, and they can help rule out rare medical problems as the cause of unhealthy weight.
- A Body Mass Index (BMI) can be calculated from measurements of height and weight. Health professionals often use a BMI "growth chart" to help them assess whether a child or adolescent is overweight.

- A physician will also consider your child or adolescent's age and growth patterns to determine whether his or her weight is healthy.

According to the scientific literature, clinical evaluation of overweight conditions in childhood should include the following measures.

Diagnosing Overweight and Risk for Overweight

- Family/Medical History and Physical exam
- Anthropometric measures
- Weight and height
- Calculate body mass index (BMI)
- Laboratory evaluation (>95th BMI)
- Chem 20; CBC w/diff; lipid profile; thyroid profile
- Maturation level (Tanner stage)

The BMI adjusts the weight of an individual by height using the formula weight in kilograms divided by the square of height in meters. In adults, a BMI value greater than or equal to 25 but less than 30 is considered overweight, and a BMI value greater than or equal to 30 defines obesity or severe overweight ⁷⁶. However, these BMI cutoffs are not appropriate for classifying children's weight status. First, childhood mortality is not likely to be related to body composition, so it is not possible to develop risk-based criteria ⁷⁷. Second, BMI typically varies with age, decreasing in the preschool years, and then increasing after about 6 years of age. Because of these changes in BMI with growth, age-specific criteria are needed. Gender-specific criteria are also needed due to differences in body composition and timing of growth patterns in adolescence for boys and girls ⁷⁸. Revised growth charts with smoothed age and sex-specific BMI percentile curves were developed by the National Center for Health Statistics for children aged 2-17 ⁷⁷. According to current standards, youth with a BMI greater than or equal to the 95th percentile for age and sex are considered overweight, and those with a BMI falling between the 85th and 95th percentiles for age and sex are considered at risk for overweight ^{73, 79, 80}.

It is recommended that children with a BMI \geq 85th percentile be further evaluated for complications associated with overweight and for recent excessive weight gain. Assessments should include the evaluation of potential genetic, endocrine or psychological syndromes ^{10, 14, 73, 81, 82}. Family medical, diet and physical activity history should be considered to identify primary

risk factors for overweight, such as parental obesity, sedentary behaviors, early feeding practices, metabolic or hormonal stress, socioeconomic factors and ethnicity^{3, 66, 82-89}.

An example of the U.S. Centers for Disease Control BMI percentiles follows:

U.S. Centers for Disease Control Body Mass Index Percentiles for Children and Adolescents*

Age (yrs.)	Healthy Weight 50th-85th %	At Risk for Overweight > 85th %	Overweight > 95 %	Severely Overweight > 97 %
5	15-17	> 17	> 18	> 18
8	16-18	> 18	> 20	> 21
11	17-20	> 20	> 23	> 25
14	19-23	> 23	> 26	> 28
17	21-25	> 25	> 28	> 30

*Males



IV. Weight Management Goals

A. Prevention of Weight Gain in Children

Obesity results when susceptible (i.e. genetically pre-disposed) individuals are placed in “adverse” environments³. Dietz⁸⁵ has suggested that there are three critical periods for the development of obesity. These include: 1) the intrauterine environment or early infancy, 2) 5-7 years of age (adiposity rebound), and 3) adolescence. Both Law⁶⁶ and Dietz⁸⁵ propose that weight and adiposity are entrained during early life. Furthermore, Troiano⁹⁰ states that often the obesity observed in adulthood originates during the early childhood years. There are several environmental factors that contribute to adult obesity. Low physical activity (PA), high calorie, high fat foods and, a resulting lowered exercise tolerance are some of many factors involved in the development of the disease^{36, 91}. However, in young children under 6 years of age, the most

important of these factors is parental obesity³. It is well accepted that the environment of the family plays a key role in the development of obesity in young children at risk for adult obesity and related diseases such as diabetes^{86-88, 92}. Research shows that parent inactivity strongly predicts child inactivity⁸⁷. Moreover, the exercise patterns of parents have a strong influence on the frequency of exercise in their children⁹³. Research also shows that parental influences are early determinants of food attitudes and practices in young children^{89, 94}. And, furthermore, that food preferences greatly influence the consumption patterns of young children. Therefore, strategies that positively alter the behaviors and environment of the family may reduce the risk of adult obesity and diabetes by improving physical activity and nutrition. This may prevent the onset of pediatric obesity and the risk of metabolic disease later in life, especially in those children with primary risk factors (at-risk). Efforts to halt and reverse obesity and related metabolic disease, therefore, should begin with young children. More importantly, educational interventions that target the parents of children at risk for obesity should be an integral part of standard pediatric and family medical care.

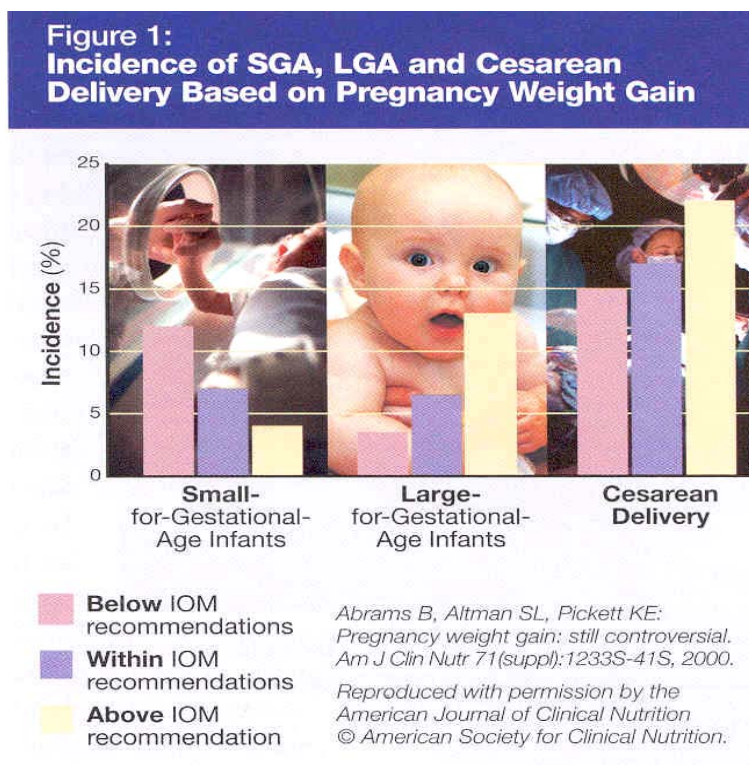
Grundy⁹⁵ sites the spread of Western lifestyle habits and industrialization as major risk factors for weight gain and its related metabolic abnormalities. Recent studies show a consistent rise in the prevalence of obesity among preschool children from low-income families⁹⁶. These children often have low levels of cognitive stimulation, which is associated with a significant increase in the risk for early onset obesity⁹².

Whitaker and colleagues⁵⁴ identified parental obesity as an important predictor of adult obesity in both non-obese and obese children under 10 years of age. Children one to two years of age with one obese parent expressed a 28 percent increased risk of obesity. Furthermore, the obesity status of children over six years of age was shown to be a strong predictor of adult obesity. However, before 3 years of age the obesity status of the child was not a predictor of adult obesity. And particularly in non-obese children less than six years of age, obesity in both parents significantly increased the risk of adult obesity⁵⁴. In a retrospective study of 3,277 obese adults, greater obesity prevalence was observed in the mothers of the obese individuals than the fathers⁹⁷. A similar trend was found in the obese grandmothers compared to the obese grandfathers of the subjects⁹⁷.

The critical periods for the development of obesity in children include gestation, 5-6 years of age, and adolescence⁹⁸. Five to six years of age was identified as a potential period of

adiposity rebound in children ^{55, 99}. An excessive protein intake at the age of 2 years was shown to promote increased fatness at 8 years of age, suggesting that a high protein diet early in life could promote an increased risk of obesity later in childhood ⁹⁹. Current research also supports that breast-fed children have a lower risk of obesity than formula-fed children ¹⁰⁰⁻¹⁰³. Those infants that breast-fed for longer durations had an even lower risk of childhood obesity ¹⁰⁴.

Research indicates that weight and adiposity are significantly influenced by early life experiences ^{66, 85}. Jackson and colleagues provide a strong argument for nutrition-induced changes in the hypothalamic-pituitary-adrenal axis in the mother and the fetus ⁵⁶. Therefore, the local availability of nutrients during pregnancy, especially in relation to protein intake, has strong implications for future metabolic health. This relationship may reflect adjustments that occur to protect brain tissue preferentially over visceral and somatic growth resulting in an altered metabolic profile ⁵⁶. Stern and others ¹⁰⁵ suggest that the impact a thrifty genotype on the birth weight may actually worsen an already altered metabolic profile later in life. Thus, nutrition during and after pregnancy has strong implications for future obesity and related chronic disease (Figure 1). Moreover, low birth weight and breast-feeding history should be considered factors in obesity development in young children.



Early Maternal Counseling to Prevent Obesity in Youth (Mendelson, submitted for publication #786)

Recent evidence implicates slow fetal growth and low birth weight as risk factors for several adult chronic diseases including obesity and diabetes. In addition, although not conclusive, there is emerging research suggesting that excessive weight gain prior to and during pregnancy is associated with metabolic disease in the offspring, even in the absence of maternal diabetes. During pregnancy expectant mothers are provided with some information on the importance of maintaining a healthy weight, but this information is not specific to the increased obesity risk implied to the baby. Thus, ObGyn health care professionals may be well positioned to provide valuable, vital information that may have a dramatic impact on reducing the current worldwide obesity epidemic. To date, early maternal counseling to reduce the risk of obesity and metabolic disease in the offspring has not been implemented or evaluated.

Expectant parents all over the US and Canada spend months going to classes with other expectant parents to learn from public health nurses (others) how to deal with the birth of their babies. However, once the baby arrives, parents have no such resource available to them to help them with the more day today challenge of raising healthy children. Whereas public health offers programs for mothers at risk, all new parents would benefit from support during the “foundation years” (birth to six years old) to help them develop strategies for healthy living. The elements of the “parenting clubs” would include healthy eating and physical activity to promote optimal health and prevent obesity for young children. Other matters could include injury prevention and healthy relationships. (For older children, programs may focus on matters appropriate to the older groups)

Providing children with the foundations of healthy eating and physical activity are not necessarily intuitive for parents. For example, many parents believe that they are doing the best thing for their children when they encourage them to eat all of the food on their plate, when they reward them with dessert for eating their vegetables, and when they offer them “treats” as a way of granting them praise. Many parents are unaware that research has demonstrated these traditional patterns can create significant problems for their children. Such interference with the child’s normal appetite mechanisms will undermine their ability to know when they are hungry and when they have eaten sufficient food. Likewise, restricting children’s food intake can undermine good eating habits. When food intake is carefully controlled by their parents, children

lose the ability to respond to their own appetite mechanisms and are more likely to overeat when abundant amounts of food are available. Armed with good information, parents who learn appropriate feeding strategies can positively influence their children's attitudes towards food, food behavior and ultimately, their health and well-being.

Similarly, parents need information and support to foster healthy physical activity patterns in their children. Sedentary behaviors such as TV-watching and computer games are now common fare in most American homes. Typically, children begin gaining unnecessary weight between the ages of three and seven years. By then, they are spending a good deal of time sitting behind a desk at school. After school, they might play video or computer games, or watch several hours of television. And, it only takes a few extra pounds to make a child's clothes feel uncomfortable, restrict movement and reduce enthusiasm. When children slow down, weight gain speeds up. The physical repercussions are not easy to recognize except when overweight children exert their bodies during active playtime. Then, they are likely to become short of breath, overheated, and sweat heavily. At this point, overweight children may begin to feel inadequate at sports or other physical activities leading to a more sedentary lifestyle, which exacerbates weight gain. Other children may tease them relentlessly and they may turn to food for comfort, which causes more weight gain. Participation in physical activities becomes even more difficult and indoor activities such as television and computer games replace outdoor play. Kids who become overweight are reluctant to undertake physical activity and a vicious cycle begins. Preventing the cycle is more likely to reduce obesity in children.

Increasing physical activities does not, however, automatically assume increased structured exercise. Well-meaning parents may mistakenly assume that large bouts of vigorous exercise may provide the best defense against obesity in their young children. What they fail to realize is that young animals, including humans, are inherently physically active. Young children will be physically active if given encouragement and opportunity. Childhood physical activity is often intermittent and sporadic in nature; thus, children will not likely participate in prolonged exercise without rest periods. However, if given the opportunity, young children will perform relatively large volumes of intermittent non-structured physical activity. Therefore, physical activities targeting young children, should be intermittent consisting of short time frames of vigorous activity alternating with longer periods of low intensity activity. Providing safe environments for young children to actively play outdoors is essential to increasing physical activity patterns. If children self-select activities they enjoy they are more likely to perform those activities more

often and for longer periods of time. If parents can provide opportunities for their children to engage in frequent bouts of non-structured physical activity throughout childhood, they may help to prevent the onset of obesity, especially in those children most at risk. Likewise, if they ensure a positive experience when participating in physical activity, their children are more likely to continue being active throughout adulthood.

Some simple strategies that parent can use to develop healthy eating and physical activity habits and prevent obesity in children:

1. Breast-feed. Babies who control their own intakes develop appetites in tune with their energy needs.
2. Shopping for food is the most important activity for establishing what the family will eat at home. Always shop with a list that is based on meals your family will be eating; include plenty of fruits and vegetables (fresh, frozen or canned; they all count), buy whole grain cereals and lower fat dairy products. Don't go to the market when you are hungry to avoid buying those foods that are not on your list
3. Present your child with a selection of healthy foods and let her decide on how much to eat
4. When the meal is over, clean up and leave the kitchen until the next meal. Keep food in the kitchen only and have meals there. No need to turn the whole house into a feeding room.
5. When children are bored or lonely, find a solution to the real problem. Do not use food as a substitute for friendship or entertainment.
6. Decrease TV/computer time by creating an imagination station with safe indoor, active toys in the corner of the family room. Turn on the stereo instead of the TV and teach your child to cha cha, tango or waltz. Let your child take a 5-minute physical activity break every 30 minutes of TV, computer and even homework! Do commercial boogie – dance or stretch during commercials.
7. Increase weekend physical activity by dedicating at least one half day each weekend to outdoor family fun. Create an environment for active play outside. Purchase a wagon, bicycle, swing set and a large plastic tub filled with balls, jump ropes, skates, games, etc. Play a game of family football during the first and third quarter of televised games—you'll still get to watch the 4th quarter to see who wins.

8. Increase opportunities for your child to develop muscular strength, endurance and flexibility. Provide opportunities for young children to safely climb, run and jump to help develop muscle strength and bone density.

Parenting clubs can provide new parents with a supportive and informed program to help them create a healthy lifestyle for their own families. By creating a healthy living agenda for families within their own communities, we can improve the health of the community and ultimately the larger jurisdictions (Mendelson, submitted for publication #786.)

Environmental factors may contribute as much as 80% to the causes of childhood obesity. These factors include increased caloric and fat intake e.g. energy-dense foods and beverages, irregular meal patterns, snacking and dining out, and sedentary behaviors, such as television viewing^{106, 107} and absence of regular physical activity⁷¹. Research suggests that obese children demonstrate decreased levels of physical activity and increased psychosocial problems. Table 1 details risk factors associated with the development of childhood obesity.

Table 1: Risk Factors for the Development of Childhood Obesity

1. Parental obesity
2. Sedentary behaviors such a TV-watching and computer games
3. Poor nutrition
4. Unhealthy food attitudes and practices
5. Low socioeconomic status
6. Low birth weight (small for gestational age [SGA])
7. Formula versus breast-feeding

Obesogenic Families

(Davison and Birch, Int'l J of Ob, 2002)

A recent study examined the self-reported physical activity and dietary intake patterns of parents and changes in weight status (body mass index and skin folds) over 2 years in offspring¹⁰⁸.

- Girls of parents with high dietary intake and low physical (obesogenic) had significantly greater increases in weight status.
- Family environment may explain increased weight status in children over and above genetic susceptibility.

Nutrition and the Prevention of Childhood Obesity

The social-affective context in which foods are presented to young children greatly impacts their food preferences^{94, 109, 110}. Children as young as three years of age will communicate freely their likes and dislikes concerning food¹¹¹. If left unattended, young children will select foods they enjoy and leave behind foods they dislike¹¹². Since food preferences greatly influence the consumption patterns of young children⁹⁴, understanding factors that encourage food preferences is important to promoting healthy eating patterns. In young children, the parents are the primary providers of food and, thus, have a direct impact on how nutrition is perceived by their children. For example, Birch¹⁰⁹ found in a study of 64 preschool-aged children that foods presented as rewards enhanced preference for that food. Furthermore, in a follow-up study providing rewards for consuming nutritious foods initially enhanced the preference for that food, but later produced a negative shift in preference for the nutritious food. This was especially true once the reward or contingency was removed^{113, 114}. Therefore, strategies that promote the consumption of a certain food in order to receive a reward discourage the child's preference for the healthy food¹¹². Encouragement of heart healthy dietary intake patterns may prevent the onset of obesity in 4-7 year-old children¹¹⁵. Conversely, obesity in mothers influences fat intake in their children 4-7 years of age thereby contributing to the development of obesity¹⁰⁷. It is obvious that parental influences are early determinants of food attitudes and practices in young children⁸⁹. Therefore, it is vital that obesity prevention strategies that promote healthy nutrition involve the parents.

Nutrition education is an important part of prevention and treatment methods for childhood obesity¹¹⁶. Epstein and colleagues demonstrated long-term success in treating young, mild to moderately overweight children, thus preventing the onset of adult obesity, using a nutrition intervention called the Traffic Light Diet. The diet does not specify calorie or nutrient amounts, but, rates foods according to nutrient value¹¹⁷. Similar results were observed in another study of children participating in a clinical program that included a modification of the traffic light diet and exercise¹¹⁸. Kindergarten students were shown to understand the relationship between diet, body fat and health¹¹⁹. However, this knowledge did not coincide with their food preferences. The authors suggested that nutrition education should provide opportunities for the children to practice how to select healthy foods that have acceptable flavors¹¹⁹. This practice, however, needs to involve the parents as school-based programs are not shown to generalize to home environments¹¹⁴. Moreover, the food preferences and consumption patterns of younger children are more influenced by peer-modeling than older children^{113, 114}. Studies indicate that children who were exposed to peers who were selecting alternate foods

changed their food preference ¹²⁰. Routinely exposing young children to other children with different, healthier preferences may promote a larger acceptance of nutritious foods. A group, family intervention clinic may provide opportunities for peer modeling between young children, thus indirectly impacting their food preferences.

By the time children enter kindergarten their food preferences and the social context with which they associate foods are already established ¹²¹. Infants whose parents were instructed in health education emphasizing fat-prudent diets were less likely to be obese at 3 years than age-matched controls ⁹⁸. Therefore, educating the families of young children concerning nutrition may have a powerful, positive impact on the obesity risk of those children, especially those with obese parents. Based on the limited research in prevention of obesity in young children, successful prevention should include family interventions with nutrition and physical activity education, and behavior modification. These interventions should be delivered by a team of health care experts in a nurturing, non-intimidating environment ¹²².

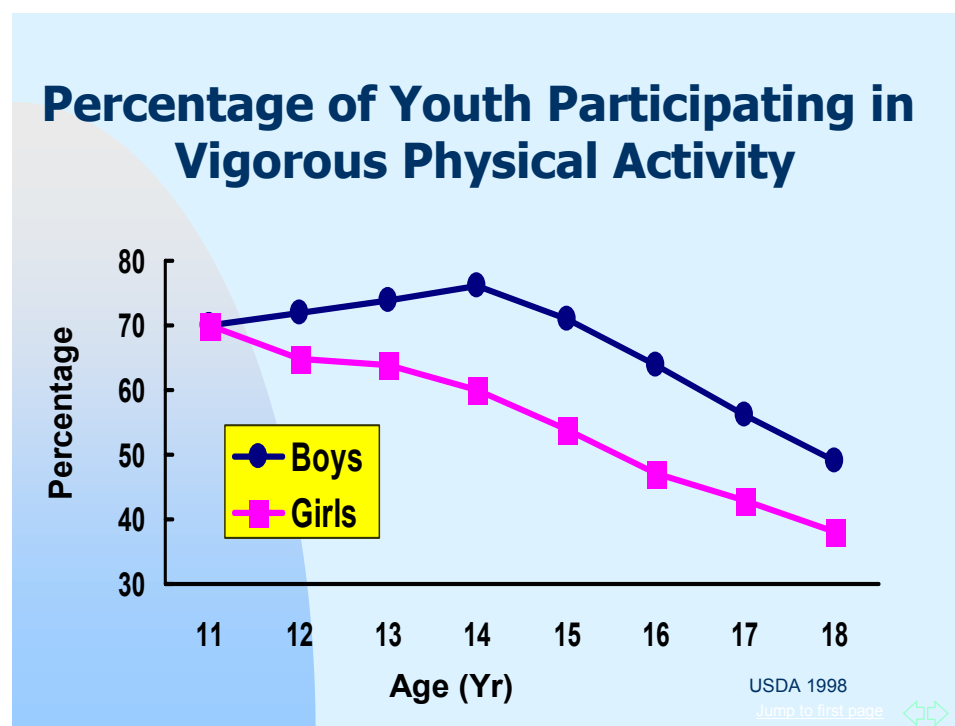
Table 2: Nutrition Tips for Parents of Young Children*

1. Create a safe home food environment: Display and keep within reach nutritious foods naturally low in fat and sugar. Make sure the serving sizes are appropriate.
2. Allow infrequent consumption of non-nutritious foods away from the home. Gradually reduce fast food consumption to less than one time per week.
3. Discourage the consumption of high sugar beverages such as soft drinks. Give your child water when he or she is thirsty.
4. Select healthy fruits and vegetables as treat foods such as grapes, raisins, strawberries, cucumbers, carrots, etc.
5. Help your child to understand that there are no “bad” or “good” foods. Some foods are healthy, “grow tall or big” foods and some are not. Encourage children to select more of the healthy variety and NEVER give food as a reward.
6. Require that all drinks and foods be consumed at the kitchen or dining table or other designated area of the home.
7. Serve children an appropriate portion size (usually about ½ cup) of each food prepared. Children will eat more if you serve them more.
8. Require that children take at least 3 bites of each food prepared, especially vegetables. Then have them grade the foods: A, B, C, D or F. If it gets a grade of A, B or C serve it again. If it gets a lower grade prepare the food a different way next time.
9. Teach children that it is okay to leave food on their plate. This teaches them to self-regulate and not to overeat.
10. Schedule mid-morning and mid-afternoon healthy snacks. Make them attractive.
11. Always require children to eat a healthy breakfast and discourage snacking after dinnertime. If children are not hungry when they awake they are eating too late at night.
12. Don't give negative attention to unhealthy eating. Rather, spend your energy praising your child when he chooses healthy foods.

*reprinted with permission: Sothorn, et al, Trim Kids, 2001, Harper Collins, NY, NY ¹²³.

Physical Activity and the Prevention of Childhood Obesity

Evidence continues to support reduced physical activity and sedentary behaviors, such as television viewing, as primary causes of the current worldwide obesity epidemic⁵⁰⁻⁵². Physical activity patterns begin to decline dramatically in girls by age 11 and in boys by age 14 years (USDA, 1998)



Several researchers have published results of programs that target decreases in sedentary behaviors as methods to increase physical activity and reduce obesity in children^{52, 124-126}. It is possible that for many children increasing physical activity may be adequate to prevent the onset of childhood obesity^{51, 126-128}. Because young animals, including humans, are inherently active, young children will be active if given encouragement and opportunity^{74, 129}. Childhood activity is often intermittent and sporadic in nature¹³⁰; thus, children will not likely participate in prolonged exercise without rest periods. However, if given the opportunity, young children will perform relatively large volumes of intermittent non-structured physical activity^{74, 129, 130}. Generous periods of free play are highly recommended along with frequent periods of adult-initiated moderate to vigorous activities including the participation of parents and teachers^{74, 127, 131}. Encouraging active play as a means for increasing overall energy expenditure has been

shown to be effective in reducing obesity in 5-8 year-old girls ¹²⁹. Providing safe environments for young children to actively play outdoors is essential to increasing the physical activity patterns of overweight children and those at risk for obesity ¹²⁷. This may only be accomplished through policy changes, environmental planning and school/community educational efforts.

Motivating young non-obese, physically active children to maintain activity patterns may be less challenging than increasing patterns in already obese older children. Javernick ¹³¹ suggests that just monitoring children during free play does not encourage the participation of heavier children. Heavier children are often ignored, ridiculed ¹³² and often choose indoor, sedentary activities to escape negative activity situations ¹³¹. Therefore, encouraging the sedentary, obese child to participate in physical activity is difficult. In addition, even mildly overweight children have a decreased exercise tolerance; movement may be uncomfortable and, in some cases, painful ^{36, 48, 91}. Structured and vigorous, aerobic-type activities when prescribed to overweight children, regardless of the individual's cognitive, physical and emotional stage of development, may result in non-compliance or physical injury. Prior failure to motivate and maintain increased physical activity in overweight or obese children may be attributed to inappropriate exercise recommendations ^{91, 133, 134} and a lack of physical opportunities for overweight children in the traditional school environment ¹³¹. In addition, emotional problems may further inhibit successful motivation of sedentary children ^{3, 91, 132}.

It is possible that for many children increasing physical activity may be adequate to prevent the onset of childhood obesity ^{51, 126-128, 135}. In addition, educational studies indicate that physical fitness improves students' self-image and promotes a positive school environment ^{136, 137}. Students who are physically fit are shown to be absent less often and illustrate higher academic achievement than non-fit students ¹³⁶.

Because young animals, including humans, are inherently physically active, young children will be physically active if given encouragement and opportunity ^{74, 129}. Childhood physically activity is often intermittent and sporadic in nature ¹³⁸; thus, children will not likely participate in prolonged exercise without rest periods. However, if given the opportunity, young children will perform relatively large volumes of intermittent non-structured physical activity ^{74, 129, 138}. Generous periods of free play are highly recommended along with frequent periods of adult-initiated moderate to vigorous activities including the participation of parents and teachers ^{74, 127, 131}. Providing safe environments for young children to actively play outdoors is essential to

increasing the physical activity patterns of overweight children and those normal weight children who may be at risk for obesity ¹²⁷.

Physical Activity – Target Populations for Prevention of Childhood Obesity

Successful prevention of obesity and related chronic disease is dependent upon maintaining and/or increasing the physical activity of young children at-risk for obesity ³⁷. Moore and colleagues ¹²⁸ examined the impact of physical activity on preschool body fatness using triceps and sub scapular skin folds measures. Ninety-seven children with a mean age of 4.0 years were studied over 2.5 years. Caltrac accelerometer measures indicated children with low levels of physical activity had an increased risk for elevated subcutaneous fat than children with higher physical activity levels ¹²⁸. The risk was greater in those children who were heavier at baseline measures. However, the relationship between parental obesity and the physical activity of their offspring remains undetermined. Goran and colleagues ¹³⁹ found no relationship between the energy expenditure of children 4-7 years of age and the obesity of the parents. This suggests that young, non-obese offspring of obese individuals may still possess physical activity patterns similar to children of non-obese parents. There may be a unique advantage to targeting prevention efforts to these younger at-risk children because sedentary behaviors may not be present until later in childhood. Motivating young non-obese, physically active children to maintain activity patterns may be less challenging than encouraging in already overweight youth ¹²². Even mildly overweight children have a decreased exercise tolerance ^{122, 140} and emotional problems that inhibit successful motivation ^{3, 34, 36, 91}. Furthermore, young obese children are shown to be least preferred by peers in similar manner as handicapped or disabled youth ¹³².

There are three methods shown to be effective in increasing physical activity and/or reducing obesity in young children. These are: 1) increased opportunities, methods and environments for unstructured physical activity or free play; 2) reductions in television viewing; 3) parent training sessions and family behavioral counseling ¹⁴¹⁻¹⁴⁴. Researchers suggest that forcing children to participate in structured exercise may negatively impact physical activity patterns later in life ^{145, 146}. Young children are easily distracted and incapable of focused activity for long periods of time. This contributes to the sporadic nature of their physical activity. Adults can engage in long duration exercise easily because of their enhanced ability to concentrate and participate without much mental effort. Although most individuals engage in activity because they enjoy the effort,

children need activity to be fun in order for them to continue. Physical activities targeting young children, therefore, should be entertaining and enjoyable.

Family behavioral counseling including parent limit-setting techniques is shown to be an effective method for changing eating and activity patterns in obese children in clinical settings¹⁴⁷. Dietz & Gortmaker, 2001 recently⁸⁶ advocated parent limit setting techniques to enhance intervention programs to reduce TV-watching in youth. The inclusion of parent training in educational interventions may, therefore, reduce compensation at home and enhance physical activity. Further research is needed to examine the inclusion of family behavior counseling and parent training as a method of preventing obesity in young children.

Reducing Sedentary Behaviors

American children spend a great deal of time engaged in *sedentary activities*, particularly television viewing and other media use. A recent nationally representative media study found that youth aged 2-18 years spend an average of 5 hours and 29 minutes per day using various types of media¹⁴⁸. Television viewing has been shown to be consistently associated with overweight in cross-sectional studies of children and adolescents, although the strength of the association varies^{124, 149-153} (Ettner, 2000 #805). In another study, the direct relationship between hours of television viewing and overweight disappeared after controlling for ethnicity and socioeconomic status¹⁵⁴. Thus, although research supports the link between television viewing and overweight, it is likely that the relationship is complex and is modified by other factors.

Television provides a substantial environmental exposure for the vast majority of American children and children's programming presents a steady "diet" of commercials for foods, particularly energy dense food products. In a study of the advertising content of nationally broadcast Saturday morning children's television, nearly half were for foods, the majority (91%) of which were high in fat, sugar, and/or salt; no ads promoted fruit and vegetables¹⁵⁵. Studies have suggested that the attention level of children as young as 3-4 years old increases at the onset of a commercial, that commercials increase children's preference for advertised products¹⁵⁶ and that children who are heavy TV viewers are more likely to have unhealthy perceptions about nutrition than children less frequently exposed to TV¹⁵⁷. Further, Lewis¹⁵⁸ found that food commercials more strongly influenced appetite for sweets in overweight than in non-

overweight children. In addition media exposure appears to heighten weight concerns among children ¹⁵⁹.

Aerobic Fitness and the Prevention of Childhood Obesity and Metabolic Disease

Reduced physical activity exacerbates metabolic disorders and promotes further increases in body fat. These increases are met with a parallel reduction in exercise tolerance or maximal oxygen consumption ($VO_2\text{max}$) ^{41, 49, 122, 160}. This reduced exercise tolerance is evident during weight-bearing, sub maximal exercise of low, moderate and high intensities ⁴⁸ and, when $VO_2\text{max}$ is expressed relative to body weight (ml/kg/min ¹²²). Reductions in exercise tolerance in obese children are the result of excess body fat that provides an increased workload during weight bearing exercise, an impaired cardio-pulmonary (aerobic) conditioning and, reduced skeletal muscular strength and endurance ^{41, 48, 134}. All of these conditions are the by-product of sedentary behaviors and a lack of opportunity for daily physical activity. Either individually or in unison, these impairments predispose children to obesity and chronic diseases, such as diabetes, later in life. Recent studies in adults report that differences in the characteristics of muscle composition are related to insulin resistance, muscle oxidative enzymatic capacity, systemic adiposity and, more importantly, $VO_2\text{max}$ ¹⁶¹. The benefits of aerobic exercise training in adult Type 2 diabetic patients are well established ³⁷. Aerobic fitness may, therefore, provide a protective mechanism in children and adolescents at-risk for obesity and Type 2 diabetes. However, this mechanism has not been examined in young children who are at risk for obesity and related metabolic disease.

Studies show that chronic exercise training elicits metabolic benefits in sedentary, overweight children, 9-12 years of age ¹⁶². The adult research literature suggests that regular exercise training (>6 months) improves fat oxidation (increased oxidative enzymes), glucose metabolism (increased number of glucose transporters and glucose into triglycerides), mitochondrial function, sympathetic nervous system activity (improved catecholamine stimulation response), and lipoprotein lipase activity, which may, indirectly, positively impact metabolic profiles ¹⁶³⁻¹⁶⁷.

Regular exercise training improves the oxygen transport system promoting a preference for lipids as fuel due to an increased capacity to release and replenish lipid substrates. However, the positive outcomes of regular training are reversed within 2-6 weeks after cessation of training.

Exercise training is associated with:

- increased fat free mass
- increased resting metabolic rate
- increased fat oxidation
- Enhanced mitochondrial function
- increased sympathetic nervous system activity
- Improved glucose metabolism
- increased metabolic activity of fat free mass

Endurance trained muscle stores more glycogen and fat than untrained muscle.

- Oxidative enzyme activity increases
- Free fatty acid levels increases
- Increased use of fat as an energy source
- Sparing of muscle and liver glycogen
- Lactate threshold increases reflecting an improved ability to perform higher intensity exercise aerobically.

Exercise improves oxygen transport promoting a preference for lipids as fuel

The increased capacity to release and replenish lipid substrates is due to:

- Improved response to catecholamine stimulation
- increased number of glucose transporters
- increased glucose into triglycerides
- increased lipoprotein lipase activity

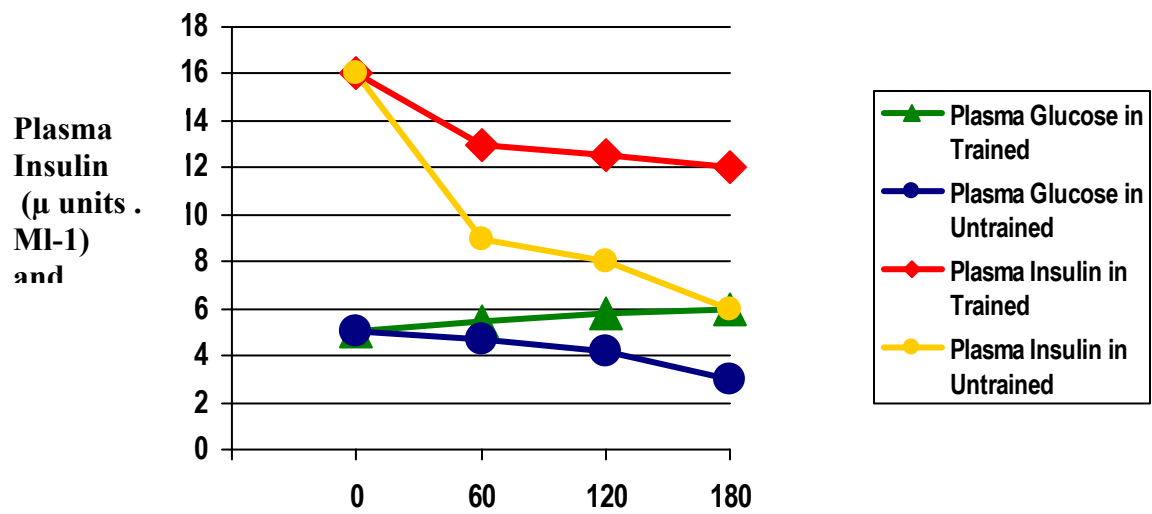


Table 3: Tips to Encourage Young Children to be Physically Active*

1. Ask your child to walk briskly whenever and wherever he or she walks.
2. Create an environment for active play both inside and outside the home.
3. Limit time spent watching TV and playing computer games to less than 2 hours per week.
4. Remove TV and computer game sets from the child's bedroom.
5. Expose your child to as many different kinds of physical activity as possible in a nurturing, non-intimidating environment.
6. Enroll your child in an activity that encourages movement such as little league sports, dance, martial arts, swimming, tennis or gymnastics once per week. This will encourage friendships with other physically active children.
7. Provide opportunities for young children to safely climb, run and jump to help develop muscle strength and bone density.
8. Don't impose adult exercise goals, programs or equipment on young children, who have immature metabolic systems. Their bodies are better designed for short bursts of intermittent active play.
9. Reserve at least one day each weekend dedicated to fun, family fitness activities. Participate in activities the entire family can enjoy together.
10. Don't draw attention to sedentary activities. Rather, spend your energy praising your child when he chooses to be active and play.
11. Encourage indoor or outdoor play for 30 minutes before homework. TV is always last after play, homework, dinner, and bathing.
12. Give physically active choices: clean your room or walk the dog; help wash the car or dance in your room; help rake leaves or go for a bike ride.

*reprinted with permission: Sothorn, et al, Trim Kids, 2001, Harper Collins, NY, NY.

Prevention and treatment interventions for childhood obesity primarily promote the replacement of unhealthy eating and exercise behaviors with new healthier behaviors. Reducing television viewing time, increasing sports and leisure physical activity time, avoiding snacking, replacing high sugar beverages with water and regulating meal times are examples of simple measures to reduce the risk of obesity in children. The potential role of prevention through primary care is

currently under-rated by the medical community. In one study, it was concluded that frequent medical clinic visits in preschool aged children might reduce the degree of obesity in the patients. A wide variety of interventions to prevent obesity during childhood have been evaluated including ¹⁶⁸:

- Parental programs and family programs
- Targeted programs for individuals with risk factors
- Community interventions
- School based programs
- Media Campaigns

Parental programs and family programs

- Studies illustrate that by the time children enter kindergarten their food preferences and the social context with which they associate foods are already established ^{109, 113, 114}. Therefore, educating the families of young children concerning nutrition may have a powerful, positive impact on the obesity risk of those children, especially those with obese parents.
- Research also supports portion control strategies, such as altering nutrition labels on marketplace items and enforcing single serving packaging, to promote decreased caloric intake and a reduction in the prevalence of obesity in youth ¹¹⁶.
- Research supports that increasing fruits and vegetable consumption is associated with reduced weight status in children

Community interventions ¹⁶⁸

A community-based intervention has been more broadly defined as one that “. . . combines organizing the community and involving citizens with strategies of lifestyle, policy, and/or environmental interventions . . . [and brings] together multiple networks of public and private organizations and special interest groups to channel and coordinate their resources in a range of interpersonal, group, and mass communication strategies”. Several comprehensive community interventions fitting this description have been evaluated. Most were designed to reduce cardiovascular or diabetes disease risk and focused on adults rather than children. Examples include:

- The Heart to Heart Project the Minnesota Heart Health Program
- The Pawtucket Heart Health Program

- The Health for your Heart project
- The Sandy Lake Health and Diabetes Project
- The Stanford Five-City Project and the
- Stanford Three Community Study

Several other community-based studies have recently been completed or are currently underway which have failed to include weight status measures including:

- CardioVision 2002 in Minnesota and the 5 state overweight intervention program,
- FitWIC, designed for children participating in the Supplemental Feeding Program for Women, Infants and Children.

Several community-based interventions aimed at youth which include a measure of weight status are currently planned or in progress. For example

- The Kahnawake Schools Diabetes Prevention Project is an 8-year intervention that targets a small community of approximately 7,000 Mohawk people near Montreal, Canada.
- One pilot study organizes school and community coalitions to facilitate environmental changes that will increase walking and biking to school among youth in Chapel Hill, North Carolina;
- One pilot study targets preschool children in the childcare setting and involves social marketing and collaboration with community organizations and food establishments in a rural New York community.

Unfortunately, final outcome data of these interventions have not yet been published. Additional community-based interventions must be conducted before the efficacy of these approaches for weight maintenance and overweight prevention in youth can be determined.

School based Programs: ¹⁶⁸

Many of the prevention of obesity studies include a school-based intervention that evaluated a combination of nutrition and exercise strategies. The results of such studies are mixed. In several studies, the interventions successfully prevented an increase in BMI in primarily female students and increased physical activity and nutrition knowledge in both genders. In addition, many published school-based intervention studies did not evaluate weight gain as the main

variable of interest and were designed primarily to observe changes in cardiovascular or health, nutritional intake and/or knowledge or physical activity patterns. Regardless, many of these studies illustrated positive changes in weight status and body composition. Therefore, school environments that offer healthy food choices and increased opportunities for physical activity should be promoted. This may include initiatives to remove vending machines that offer large-portion, unhealthy snacks and the discouragement of providing unhealthy food (pizza party, donut day, etc.) as rewards for good behavior or academic accomplishment. Recently public officials from Philadelphia, Pennsylvania passed a law prohibiting vending machines in public schools.

School-based Intervention Trials conducted among children including a measure of adiposity.

First Author Year Study Name Location	Study Population	Duration	Intervention Components	Outcome Variable/ Measure of Adiposity	Findings Related to Measure of Adiposity	RATING
Randomized Controlled Trials						
Mo-suwan et al., 1998 Hat Yai municipality of Songkhla province in southern Thailand	310 students in second-year kindergartens	Approximately 30 weeks	None given	BMI, TSF (TSF value >95 th percentile for age and sex based on NCHS data was considered obese), WHC	BMI changes were NS; prevalence of obesity using TSF cutoff was 8.8% for intervention group compared to 9.7% in control group (NS); TSF, WHC were NS	+
Robinson, 1999 San Jose, CA	3 rd and 4 th grade students in 2 public elementary schools in a single school district	1 academic/ school year	None given	BMI, TSF, waist circumference, waist-to-hip ratio	Intervention children had statistically significant (p<0.05) decreases in BMI, TSF thickness, waist circumference, and waist-to-hip ratio	+
Sallis et al., 1993 San Diego County, CA	745 4 th grade students from 7 elementary schools 85% white,	2 school years	Sports, Play and Active Recreation for Kids SPARK	BMI, Sum of skinfolds (SSF)	<u>Boys:</u> Usual PE group was < SPARK with classroom teachers at end of Year 1 (p<0.05); usual PE	0

	6% Asian, 7% Latino				group was < SPARK with classroom teachers and SPARK with PE specialists at beginning of year 2 (p<0.05); NS by end of year 2; SSF was NS <u>Girls:</u> Usual PE group was < SPARK with classroom teachers and SPARK with PE specialists at end of year 2 (p<0.01); SSF was NS	
Walter et al., 1988 Westchester County and the Bronx, New York	3388 4 th through 9 th grade students (1105 students in 15 elementary schools in Westchester County and 2283 students in 22 elementary schools in the Bronx) approximately 80% white, 10% black, 6.5% other (primarily Hispanic) in Westchester; approximately 30% white, 45% black, 24% other (primarily Hispanic)	5 school years	Know Your Body (KYB)	Ponderosity (BMI)	BMI changes were NS	+
Other Trials						
Lionis et al., 1991	Students in last class of high school	9 month (school)	Modified Know Your Body (KYB)	BMI, triceps skinfold (TSF)	Mean BMI increased by 0.22 kg/m ² in the intervention students	+

Rural areas of Crete	(13-14 years old): all high schools in the two provinces (5)	1 year)			compared to 0.71 kg/m ² in control students (p<0.05, adjusted for value at baseline, age, sex). TSF thickness was NS when adjusted. Percent of students with BMI \geq 21 increased from 23.1 to 25.3 in intervention group and from 26.3 to 35.1 in the control group	
Miraglia del Guidice 2002 Naples, Italy	82 obese Italian children & adolescents (45 boys & 37 girls), ages 5 – 15 y. Obesity defined as BMI > 97 th %.	6-month intervention	Hypocaloric Diet (60% recommended dietary energy allowance for age & sex), containing 50, 30 & 20% kcal from CHO, fat & protein, respectively.	Change in BMI (based on measured ht & wt) & Triceps & subscapular skinfolds standard deviation scores after 3 & 6 months of intervention.	Mean BMI & skinfold thickness at end of therapy were sig. lower than baseline values.	+
Tamir et al., 1990 Jerusalem, Israel	829 children from 8 experimental and 8 control schools, 7-9 years old (1 st grade at baseline, 3 rd grade at follow-up).	3 years total	SEGEV program, acronym for Hebrew phrase “Keep your body healthy”, Israeli version of KYB	BMI	BMI was lower by 0.76 kg/m ² in experimental versus control groups (p<0.01)	-

¹ Intervention may include one or a combination of Dietary (D), Physical Activity (PA), Sedentary Activity (SA) or Behavioral (B) components. ¹⁶⁸:

The new Louisiana state policy that requires daily physical education class should be enforced.

- Classes should include at least 30-60 minutes of moderate activity 5 times per week and 20 minutes of vigorous activity at least 3 times per week (Healthy People 2010).

- Classes should include strength, fun and entertaining aerobic activities (including sports and dance) and flexibility exercise.
- Schools should offer increased opportunities to engage in free or unstructured play in younger children during the school day—at least 15 minutes of recess in the morning, 30 minutes at lunch and 15 minutes in the afternoon to allow adequate opportunity to engage in moderate to vigorous physical activity.

School-based studies targeting the parents with educational programs to reduce TV watching and computer games are also shown to be effective at significantly reducing the BMI of children. The school environment should be a primary target for efforts to educate parents concerning the reduction of sedentary behaviors at home such as TV and computer games. Schools should be encouraged and provided resources to:

- Integrate proven obesity prevention, school-based programs into the school curriculum to provide ongoing opportunities for school children to engage in and learn about healthy eating and physical activity.
- Promote school-initiated programs that encourage parents to limit TV-watching, computer games and promote family physical activity.

Media Campaigns

A program entitled “Fighting Fat, Fighting Fit”, which used the mass-media to target obesity in the United Kingdom was recently evaluated ¹⁶⁹. A total of 3661 respondents completed baseline questionnaires and 2112 (58%) participated in a follow-up evaluation at the end of the 6-month campaign. The participants, who were primarily overweight or obese women, reported significant reductions in weight, and in fat and snack intake, and significant increases in exercise levels, and in fruit, vegetable and starch intake. Results of this study illustrate that mass-media campaigns may promote positive behavior patterns at population level in specific subgroups.

Summary: Prevention of Childhood Obesity:

There is insufficient research to support the effective methods to prevent obesity in children and adults. However, indirect support is available through research in the successful management of childhood obesity ^{117, 141}. A logical area to begin prevention efforts would be in youth with

special emphasis on younger children^{2, 127, 170}. Although long-term maintenance of weight loss in obese adults is rare, research indicates that weight loss during childhood can be maintained into adulthood^{3, 117}. The goal for the treatment and prevention of childhood obesity is the regulation of body weight and fat with adequate nutrition for growth and development. Prevention and treatment interventions for childhood obesity should promote the replacement of unhealthy eating and exercise behaviors with new healthier behaviors^{2, 3, 150}. Reducing television viewing time, increasing sports and leisure physical activity time, avoiding snacking, replacing high sugar beverages with water and regulating meal times are examples of simple measures to reduce the risk of obesity in children^{52, 126, 170}. The potential role of prevention through primary care is currently under-rated by the medical community⁷¹. In one study, it was concluded that frequent medical clinic visits in preschool aged children might reduce the degree of obesity in the patients¹⁷¹. The Committee on Nutrition of the American Academy of Pediatrics recommends family-based therapy including diet, psychosocial therapy and exercise for obese children. Furthermore, targeting families of susceptible children with nutrition and lifestyle behavior education may create an added benefit to the other family members⁷¹.

It is well known that, if untreated, 80% of obese 10-13 year old children will become obese adults^{17, 21}. A large percent of these obese adults will develop Type 2 diabetes¹⁷² especially those with a family history of the disease and obese parents³. Subjects with low levels of historical leisure time physical activity also have a greater diabetes risk¹⁷³. Jackson¹⁷⁴ suggests that genetic make-up determines the limits of metabolic function; but, the environmental experience ultimately manifests obesity and metabolic disease. The current environmental experience of young children includes few opportunities for physical activity² and an overabundance of high calorie foods. Sedentary lifestyles and poor nutrition challenge children who are genetically predisposed to diabetes. Obesity is a logical response to this challenge. Therefore, in predisposed children, e.g. those with obese parents and diabetes history, sedentary, non-nutritious environments challenge their metabolic capacity and promote overweight conditions, reduced fitness, further inactivity and, increased sedentary behaviors (TV-watching and snacking). This results in clinically significant obesity, reduced insulin sensitivity and ultimately Type 2 diabetes later in adulthood. Research suggests that increasing physical activity and improving nutrition may significantly affect this series of events^{4, 51, 125}. By utilizing selective prevention measures it is hoped that successful prevention of obesity in young children is feasible⁷¹. To date, there are few controlled trials that have successfully illustrated prevention of obesity in non-obese children⁷¹. More prospective research is needed

in order to identify effective strategies for preventing obesity in young children. Controlled trials are required to examine the impact of family-based educational interventions on young children at risk for obesity^{3, 34, 98, 171}. This is especially true in minority and low-income populations^{3, 34, 175}. The prevention of future chronic disease in children and adults may be dependent on our ability to prevent the onset of obesity in young children. Tables 3 & 4 provide information that medical professionals can provide to the parents of children at risk for developing childhood obesity. Prevention of obesity in young children should be a primary goal of pediatricians and family health care professionals.

B. Weight Loss

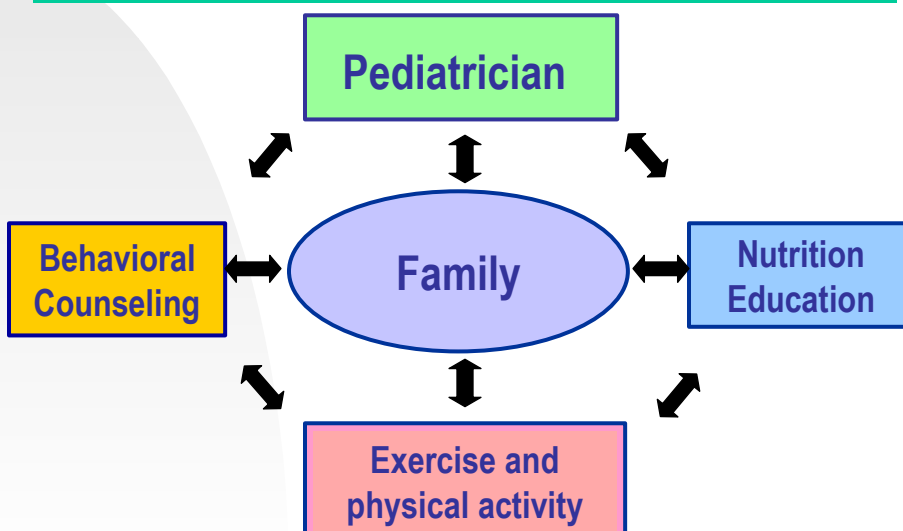
See Weight Management Techniques below

C. Weight maintenance following weight loss

See Weight Management Techniques below

V. Weight Management Techniques

Treatment of Overweight Children and Adolescents in Clinical Settings



Evidence Based Analysis of Individual and Family-based Studies in Clinical Settings

In a recent position paper by the American Dietetic Association ¹⁶⁸, researchers evaluated 40 individual based and family based studies and one meta analysis in their analysis. Due to differing entrance criteria, the meta analysis was not included in the final report. Of the studies evaluated, 27 were randomized-controlled trials and 13 were either non-randomized controlled or uncontrolled clinical outcome interventions or cross-sectional studies. All but one of the 27 randomized controlled trials received a plus/positive score. One study by Epstein and colleagues was a duplicate report and, therefore, was graded neutral. Of the 13 non-randomized trials, 8 received plus/positive scores and 5 received neutral scores. Details of a sample of the studies follow:

- Saelens and colleagues (2002) evaluated the post treatment and short-term follow-up efficacy of a 4-month behavioral weight control program for overweight adolescents in a primary care setting. The results indicated that a physician based, individual counseling program including nutrition and physical activity education was superior to a standard care approach in overweight teenagers.
- Epstein and colleagues (1985) reported that exercise enhances the outcome of the short-term treatment of childhood overweight and encourages improvements in fitness when compared to diet-only approaches.
- In a long-term (10-year) study by Epstein and colleagues (1990, 1994, 1995), weight maintenance was enhanced in children whose parents participated in the intervention program.
- Brown and colleagues (2000) demonstrated improvements in the lipid profiles and weight status of 53 subjects after a very low calorie diet, nutrition education, structured exercise, increased physical activity and behavior modification.
- Coates and others (1982) illustrated that parent participation enhanced the weight loss of adolescents enrolled in a group multi-disciplinary weight loss program including calorie restriction, exercise and behavioral counseling.

- The DISC study (1995) utilized a family based approach that combined individual and group nutritional counseling in a clinical setting. The results indicated an improvement in LDL cholesterol over a 3-year period but no improvement in weight status.
- In a 6-month month plus one-year follow-up study by Epstein and others (1995), reducing sedentary behaviors was shown to be superior over increasing physical activity in promoting maintenance of weight loss in overweight children.
- Epstein and colleagues (1985) examined the efficacy of three different types of exercise treatment programs for overweight children. They found no differences in the weight maintenance of overweight children participating in aerobic exercise, calisthenics and lifestyle during the first year of treatment. However, during the second year follow-up, the lifestyle exercise group maintained the weight loss while the other subjects participating in calisthenics and aerobic exercise gained significant amounts of weight.

Gutin and others (2002) evaluated the feasibility of implementing a physical training program in 80 obese 13-16 year olds. They participated in a standard aerobic exercise program at an intensity >70% of HR Max for approximately 30 minutes per session, 5 days per week. The program resulted in a significant reduction in total and visceral body fat.

- Becque and colleagues (1988) reported significant reduction in multiple cardiovascular risk factors using an exercise intensity of 60-80% H_rmax and progressively increasing durations of walking, jogging, swimming, and aerobic dancing over 8 weeks.
- Ebbeling and colleagues (2003) conducted a study indicating that low glycemic (LG) diets may promote significantly greater improvements in the metabolic profiles of sedentary, overweight adolescents when compared to balanced calorie meal plans.
- Sothorn and colleagues (2000) published results that the inclusion of regular resistance training in a program to prevent and treat pediatric overweight in preadolescent children is not only feasible, but also, safe and may contribute to increased retention at one year. However the study used non-concurrent controls and, thus, was not randomized.

- Epstein, et al (1995) compared the weight loss of children to their parents after 6-months and again after 10 years. However the study did not include a control group. Results were previously presented as children only.
- Eliakim (2002) examined the contribution of parental overweight to the maintenance of weight loss in overweight children, 6-16 years of age. Children with normal weight parents maintained their initial weight loss better than those with one or two overweight parents. This study demonstrated the importance of parental influence on the ability of overweight children to maintain initial weight loss.
- Epstein, et al (1993) studied the effect of weight loss by obese children on long-term growth. This study was a replicate of previously published work.
- Golan and colleagues (1998) recently demonstrated enhanced weight loss when the parents, as opposed to the overweight children, were targeted with counseling and education. High drop out rates were observed in the control groups.
- Levine and colleagues recently examined the psychosocial changes associated with family based, behavioral childhood overweight treatment programs with the following results: The results of this study indicated even after regaining weight lost initially, the depression and trait anxiety of overweight children remained improved.
- Wadden and Berkowitz recently observed a synergistic effect of adding sibutramine to a multi-disciplinary behavioral weight loss treatment intervention in adolescents.
- Epstein and colleagues showed that lipid profile adaptations associated with weight loss were observed in 56 mildly overweight children after 6 months of diet only or diet plus lifestyle exercise. Total cholesterol was not affected by treatment but high-density lipoproteins (HDL) were increased and triglycerides were decreased significantly at 6 months and again at 5-year follow-up in the diet plus lifestyle group.

Individual and family based studies contained several common elements. All studies utilized a combination of diet, exercise/physical activity and behavior modification. These studies clearly

illustrated that the inclusion of the family in counseling sessions improved both short term and long-term outcomes. And, with few exceptions, regardless of what dietary approach was implemented, both short term and long term results were similar across studies. Likewise, short-term studies were mixed concerning the effect of structured versus lifestyle exercise. Only two long-term studies examined different physical activity/exercise approaches in young children less than 12 years of age. Results indicate that non-structured approaches are more efficacious.

A. Dietary Modification

Several different types of diets have been suggested for treating pediatric obesity. Dietary strategies are also recommended for overweight children and at-risk normal weight children.

Dietary Approaches for Pediatric Obesity Treatment include:

- Nutrition education and parent training
- Portion control and/balanced calorie healthy low fat, low sugar meal plans
- Balanced, hypocaloric diets
- Very low calorie diets:
 - a. Protein sparing modified fast
 - b. Protein modified fast
- Other: Low glycemic diets; High protein, high fat diets; Meal replacement plans

Comprehensive Dietary Approaches in Clinical Settings

The short term benefits of the multidisciplinary treatment programs including dietary intervention for overweight youth are well established¹⁷⁶⁻¹⁷⁸. The health benefit outcomes of such studies are detailed below:

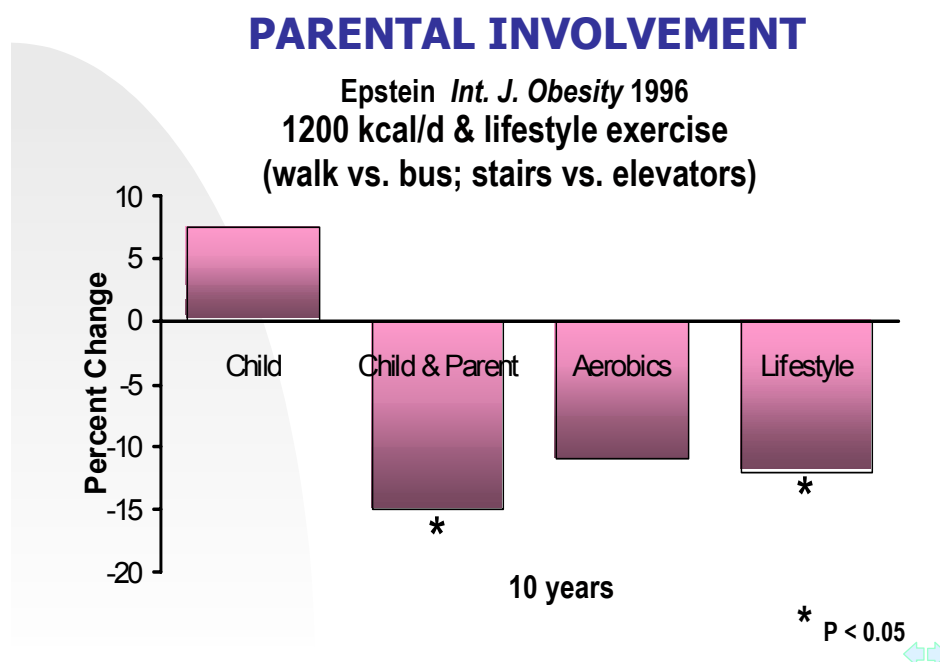
Effects of Significant Weight Loss in Short term Studies on Health Outcomes

■ Percent Fat	↓
■ Resting Energy expenditure	NC
■ Oxygen Uptake (VO ₂)	
■ absolute	NC
■ relative	↑
■ Total Cholesterol and LDL	↓
■ Growth Velocity	↓↑
■ IGF-1	↑
■ Insulin	↓
■ Leptin	↓
■ Estradiol	↓



Targeting parents with intervention efforts is shown to be effective in short term and long term studies. Family behavioral counseling is shown to be an effective method for changing eating and activity patterns in overweight children in clinical settings. Recent research advocates parent limit setting techniques to enhance intervention programs to reduce overweight conditions in youth. Targeting parents along with overweight children with behavioral interventions that include diet plus lifestyle as opposed to structured exercise enhances long-term, 10-year results in youth <12 years.

In a long-term study by Epstein and colleagues, weight maintenance was enhanced in children whose parents participated in the intervention program. In a subsequent long-term analysis lifestyle exercise was shown to be superior over structured aerobic exercise in promoting maintenance of weight loss in overweight children.



There are few long-term studies in youth >12 years of age. Most short term studies in youth >12 years indicate that group behavioral approaches using dietary and physical activity approaches individualized to the age, medical and family history, current level of overweight, physical activity level, and diet history are most effective. More prospective research is needed in order to identify effective nutrition strategies for treating overweight children especially in minority and low-income populations.

Dietary Approaches for Treating Pediatric Obesity

The best dietary approach is one that the patient will most likely follow with a high level of compliance. Secondly, the plan should include a combination of nutrients and daily calorie levels that best promote the optimal schedule of weight loss associated with the patient's medical history, current weight condition and age. Younger, less overweight children require less structure and more family education. Older, more severely obese children may need comprehensive, aggressive therapy that promotes significant weight loss. Furthermore, increasing levels of obesity decrease exercise performance in some children (Figure 3). This decreased ability makes it more difficult to encourage increased physical activity. Increasing physical activity especially during caloric restriction is absolutely necessary to prevent adult obesity and promote normal muscle and bone development. Therefore, in children with more

severe obese conditions aggressive dietary therapy may be required initially. In all cases, a pediatrician must supervise the dietary plan and monitor the child's growth and development.

Critical Opportunities for Dietary Intervention Include:

- Normal and over weight children ≤ 6 years with parental obesity
- Overweight ($>85^{\text{th}}$ % USCDC Body Mass Index Percentiles [BMI]) children and adolescents, 7-18 years
- Clinically obese ($>95^{\text{th}}$ %BMI) children and adolescents, 7-18 years
- Severely obese ($>97^{\text{th}}$ %BMI) children and adolescents, 7-18 years

According to the available scientific literature, the following dietary approaches are recommended:

Normal and at risk for Overweight Children ≤ 6 Years With Parental Obesity:

Since normal and overweight children, ≤ 6 years, with obese parent(s) are at increased risk for adult obesity, researchers recommend programs that combine nutrition education and parent training. Parents are encouraged to create a safe home food environment. They are advised to limit the quantities of high fat, high calorie snacks in the home and to promote fruit and vegetable consumption. Parents are also encouraged to observe their child's behavior for important cues such as excessive hunger, inability to become satiated or excessive shyness or isolation and to report this to their child's pediatrician.

At risk for Overweight Children And Adolescents, 7-18 Years:

Overweight children, 7 years or older, are at increased risk for adult obesity. The risk is higher in adolescents. Several dietary approaches based on portion control and/balanced calorie healthy low fat, low sugar meal plans have been shown to be successful. The Stop Light Diet uses a color-coded system to promote increased consumption of healthy low fat foods and decreased intake of high fat, high sugar foods. In addition, calorie intake is reduced by limiting the amount of food (portions) consumed by the child. Portion control also helps to re-teach the body to normalize food intake over a period of time.

Portion Control and Food labeling

Since 1970 marketplace food portions have increased in size and exceeded federal standards¹⁷⁹. The Food and Drug Administration (FDA) defines standard servings for food labels and the United States Department of Agriculture defines standard serving size for dietary guidance. Most portions of marketplace food items are double that recommended by federal standards and, in some cases, are eight times more than recommended amounts¹⁷⁹. This increase in food portion size parallels the rise in the prevalence of obese adults in the U.S.¹¹⁶. In the past decade, portion sizes of energy dense foods and beverages have increased worldwide, as well, prompting researchers across the globe to promote a focus on portion size in dietary guidelines and food labeling practices^{116, 180}. From 1984 to 1994 Americans, in particular, increased their caloric intake by an average of 340 kilocalories per day¹⁸¹. Although research continues in this area, there is sufficient data to suggest that increased portion size is a contributing factor to the worldwide obesity epidemic^{181, 182}. Studies show that both adults¹⁸³ and children¹⁸⁴ consume 30% and 25%, respectively, more energy when given access to large versus small food portions. Available data indicate that children regulate their energy intake by adjusting portion size, as opposed to increasing the number of eating occasions¹⁸⁵. Studies also suggest that children who are allowed to determine serving size consume fewer calories¹⁸⁴.

Current U.S. public policy allows manufacturers to package snack foods in portion sizes 2.5 times that which is appropriate for young children¹⁷⁹. In some states, school-aged children have daily access to self-selecting snack portions in vending machines that are more than twice recommended amounts for age¹⁷⁶. Thus, larger food portions may be one factor that helps to explain the increased prevalence of childhood obesity, which is associated with a 2.4 increased risk for elevated cholesterol^{182, 186}. Since the economic burden of obesity-associated illness during childhood has increased by 43% in the past 2 decades¹⁸⁷, public health efforts that address portion control are essential to curbing the growing epidemic of childhood obesity. Public policy that requires the portion size of snack foods to comply with FDA standards for single servings may have a significant impact on the morbidity and economic burden of childhood obesity. Thus, research supports portion control strategies, such as altering nutrition labels on marketplace items and enforcing single serving packaging, to promote decreased caloric intake and a reduction in the prevalence of obesity in adults and youth^{179, 182, 188}.

Clinically Overweight or Obese Children And Adolescents, 7-18 Years

The clinically obese child presents the greatest challenge to the health care professional. Excess weight limits exercise tolerance and promotes sedentary behaviors. Thus, it may be necessary to limit the daily calorie intake of an obese child in order to promote a noticeable weight loss. Also, caloric restriction may be necessary if previous attempts to promote reduced-fat/healthy food choices were unsuccessful. In this case a balanced hypocaloric diet may be prescribed as follows:

Balanced Hypocaloric Diet - Calorie Controlled Meal Patterns

Calories*	Meat/Sub.	Milk/Dairy	Bread/Starch	Fruit	Fat	Veg.**
1200	5 oz.	3	4	2	3	unlimited
1500	6 oz.	3	6	3	4	unlimited
1800	6 oz.	3	8	3	4	unlimited
2000	6 oz.	4	9	3	6	unlimited

by Sothorn, M., von Almen, T., Schumacher, H., from Trim Kids (Harper Collins, NY, NY, 2001)

*Daily calorie needs are based on American Dietetic Association recommendations for age.

**Try to include a minimum of two to three servings of vegetables per day.

Several researchers have reported short-term success using balanced, hypocaloric diets. Recently, we reported that significant weight loss could be safely achieved in 10 weeks and maintained at one year in obese children, 5-7 years of age. The CTK motivational program that accompanied the diet was based on Social Cognitive Theory and included a series of 52 weekly dynamic and interactive group sessions that provided entertaining nutrition, fitness and parent-training activities. The improved exercise tolerance caused by the weight loss increased physical activity. Most importantly, the program was physician supervised and was conducted in groups of families. The parents' presence was required and participation strongly encouraged.

Severely Overweight Children and Adolescents, 7-18 Years

Research consistently supports the concept that traditional dietary approaches may not promote successful weight management in severely obese children. In older obese children with a history of dietary failures it may be necessary to initially prescribe a more restrictive diet for a short-term period. Typically these children have other emotional concerns that must be

addressed during dietary treatment. Please note, however, that very low calorie diets may restrict normal growth and must be medically supervised.

Researchers at the Louisiana State University Health Sciences and Pennington Research Centers have examined a multi-disciplinary, weight management model, called Committed to Kids (CTK) along with a very low calorie diet (VLCD) that provided 600-800 kcal/day and 1.5 to 2.0 gm/kg of ideal body weight (IBW) in severely obese children (BMI= 34.1 ± 4.8 and $>97^{\text{th}}$ BMI) in several clinical outcome trials. The Protein Sparing Modified Fast (PSMF) restricted carbohydrate intake to 20-25 g/day to induce ketosis. The diet was supplemented with additional calorie free liquids (2 liters/day), a multivitamin w/ minerals, 800 mg/day of calcium and 25 meq/day KCl. Subjects reduced weight approximately 30% after 10 weeks and maintained the weight loss at one year. Resting energy expenditure and lean body mass were maintained, relative VO_2 max (but not absolute) was improved, and relative fat (%), total cholesterol and low-density lipoproteins were reduced after 10 weeks (Table 2). In one study, however, two males and four females exhibited growth velocities below the 3rd percentile for their chronological age. However, the females' heights at the end of the study were normal for the height of an adult North American female. Regardless, in some patients this severe caloric restriction may negatively impact growth velocity even in the presence of exercise and close medical supervision.

Table 2: The Impact of Significant Weight Loss with PSMF & Exercise in Obese Children

Body Mass Index	↓
Percent Fat	↓
Lean Body Mass	unchanged
Resting Energy expenditure	unchanged
Oxygen Uptake (VO_2)	
-absolute	unchanged
-relative	↑
Total Cholesterol and LDL	↓
Growth Velocity	↓↑
IGF-1	↑

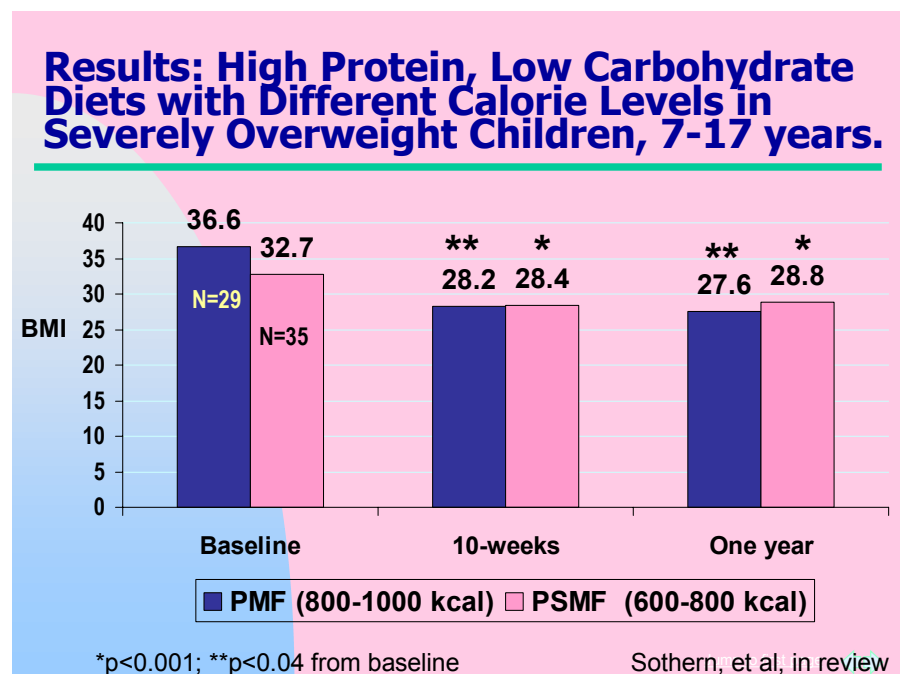
Sothorn, et al, 2001

Clinical trials conducted in adults using VLCD diets illustrate that it may be unnecessary to reduce the daily calorie level below 800 kcals/day. During the past three years our group has conducted clinical outcome trials using the CTK model with an alternative high protein dietary approach called the Protein Modified Fast (PMF) diet as follows:

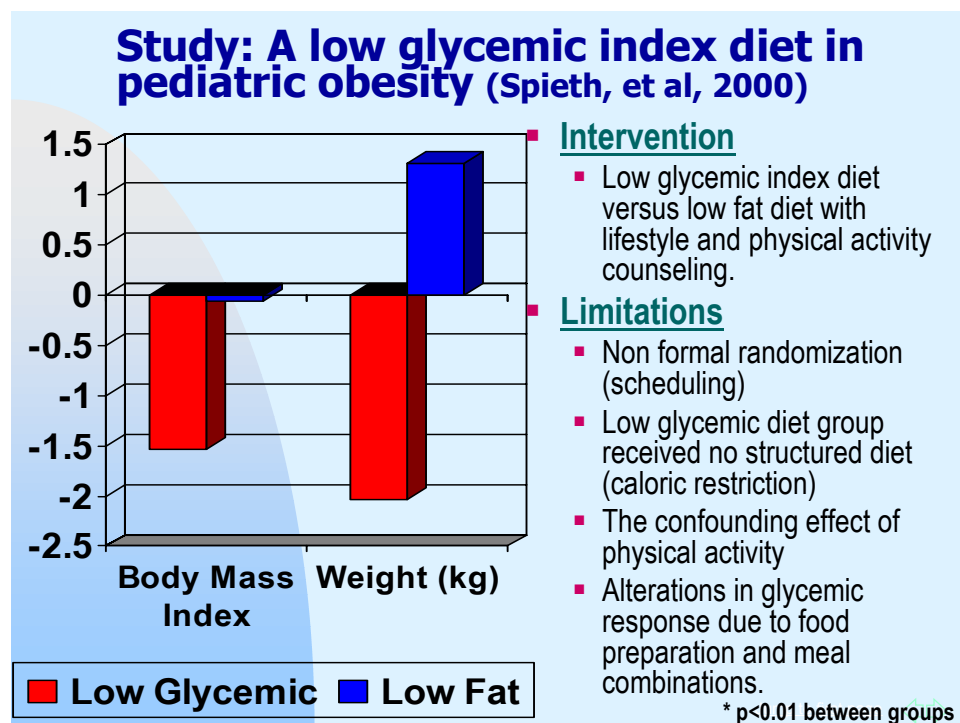
Protein Modified Fast Diet:

- 800 to 1000 calories (depending on the protein prescription)
- High protein: 2 to 2.5 gm/Kg IBW (average 90 to 140 grams per day)
- Reduced carbohydrate: 50 to 75 grams per day
- Reduced fat: 30 to 45 grams per day
- Lean meat and substitutes (13 to 20 ounces per day)
- Vegetables (reduced-carbohydrate)
- Bread/Starch/Fruit/Milk: 2 to 3 units/day combined (45 to 50 gm of carbohydrates)
- Free foods such as tea, mustard, bouillon, pickles, spices.
- Fluid: 64 to 96 ounces minimum per day
- Supplements: Daily multivitamin with minerals, Elemental calcium: 1200 to 1400 mg per day. Additional potassium may be necessary
- Duration: 10 to 20 weeks

This PMF diet is higher in total calories, protein and carbohydrate than the PSMF diet and, is a non-ketogenic approach. We compared subjects receiving the PMF diet plus CTK to subjects who were prescribed the traditional PSMF diet plus CTK.



Both groups had significant reductions in BMI percentile at 10 weeks that were maintained at one year. In addition, although the PMF was higher in calories, the change in BMI did not differ between the groups. Although, preliminary, these results suggest that it may be unnecessary to reduce calories below 800 kcal/day. Since PSMF may negatively impact growth velocity in some children, PMF may provide a useful alternative in severely obese children. However, this warrants further investigation under randomized, controlled conditions. Other approaches, such as low glycemic diets and meal replacement plans are also currently under investigation. Recent studies indicate that low glycemic (LG) diets may promote significantly greater improvements in the metabolic profiles of sedentary, overweight adolescents when compared to balanced calorie meal plans^{189, 190}. However studies in healthy weight, well-trained individuals are lacking. There are, however, a growing number of studies that examine the impact of LG diets on exercise performance.



Proposed Initial Dietary Approaches by Medical History, Age & Level of Obesity:

Medical History, Age and Weight Condition (BMI %)	Dietary Approach
≤ 6 years, normal or overweight w/ obese parents	Family nutrition education and parent training
7-18 years, at risk for overweight (>85 th %BMI)	Portion control and/balanced calorie healthy low fat, low sugar meal plans Family nutrition education and parent training
7-18 years, clinically overweight or obese (>95 th %BMI)	Balanced hypocaloric diet Family nutrition education and parent training
7-18 years, severely overweight (>97 th %BMI)	*Alternative diets: Protein Modified Fast, Low Glycemic Diet, etc. Family nutrition education and parent training

* Medical professionals should only prescribe alternative diets in patients with severe obese conditions or other serious medical concerns that require weight loss. Use of very low calorie

diets in patients with short stature should be delayed until the patient reaches his or her full growth potential unless the excess weight presents a life-threatening situation.

Use with Other treatments

Refer to Multi-disciplinary Programs

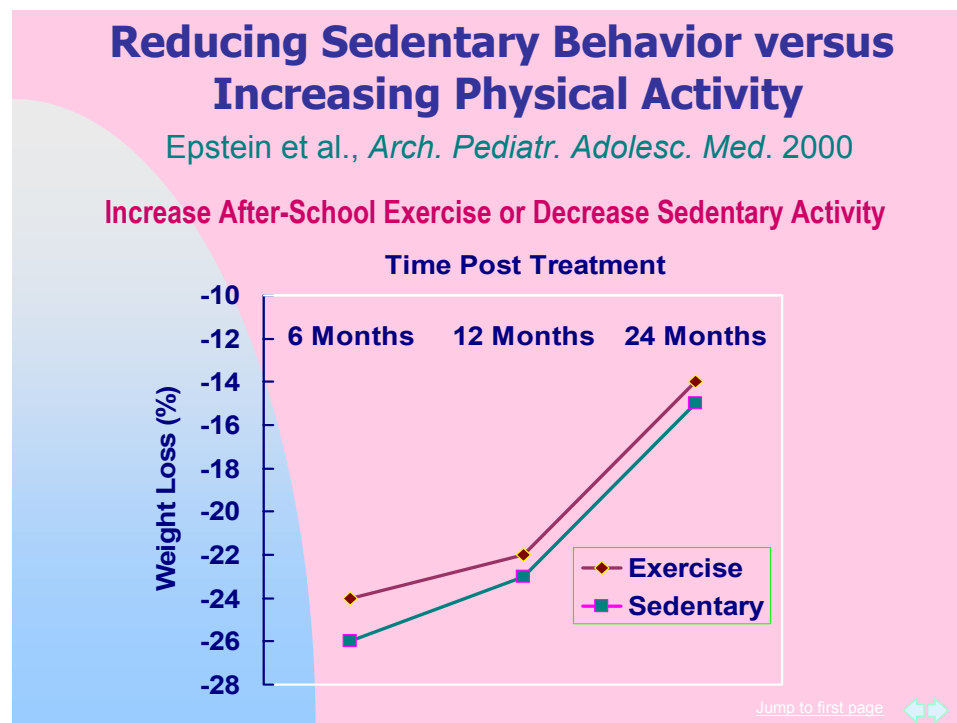
B. Physical Activity

Exercise prevention and treatment recommendations for childhood obesity include reductions in sedentary behaviors, participation in activities with a high caloric cost and walking programs^{51, 142, 144, 191, 192}. Structured exercise alone has been shown to significantly improve body composition over 20 weeks in a multi-ethnic group of obese 16-65 year old males and females¹⁹³. The changes, however, were small and of limited biological significance suggesting that programs should be sustained for longer time periods¹⁹³. Frequent vigorous physical activity periods have also been shown to be associated with decreased abdominal fat in male adolescents¹⁹⁴. Gortmaker and colleagues¹²⁵ and Mo Suwan¹⁹⁵ evaluated exercise interventions in school-based settings. The interventions successfully prevented an increase in BMI in the female students but not the male students. Conversely, Donnelly¹⁹⁶ observed no change in the BMI of students participating in a nutrition and physical activity program. Furthermore, some researchers suggest that forcing children to participate in structured exercise may negatively impact physical activity patterns later in life¹⁴⁶. Young children are easily distracted and incapable of focused activity for long periods of time^{74, 129, 130}. This contributes to the sporadic nature of their physical activity. Adults can engage in long duration exercise easily because of their enhanced ability to concentrate and participate without much mental effort. Although most individuals engage in activity because they enjoy the effort, children need activity to be fun in order for them to continue^{74, 128, 129}. Adults are more able to engage in challenging activities in order to reach performance or aesthetic goals. Young children, on the other hand, are not concerned with appearance and not overly concerned with winning or competition^{74, 129}. Physical activities targeting young children, therefore, should be entertaining and enjoyable.

The recommended clinical treatment of childhood obesity includes individual and group multidisciplinary programs utilizing dietary intervention, behavior modification and exercise^{3, 73, 197, 198}. It is unclear what types, amounts and intensities of exercise may be safely and effectively

utilized to treat childhood obesity. Specific guidelines for intensity (how hard or fast), duration (how long), frequency (how often) and mode (type of activity) of exercise are unclear^{36, 41, 48}.

Some investigators support the use of weight-bearing activities, such as walking and jogging, in obese children^{142, 144}. Others indicate that weight-bearing activities may not be appropriate due to the risk of injury and associated discomfort. In a well-controlled, randomized trial, Epstein demonstrated that programs that promote reductions in sedentary activity versus were equally as effective at one year and more effective after two years in promoting maintenance of weight loss in overweight children.



Structured Exercise Programs In Clinical Settings

Few studies have reported success in treating moderate to severe conditions of childhood obesity. Epstein and colleagues¹⁹⁹ and Reybrouck and associates²⁰⁰ found that obese children and adolescents had greater weight loss when exercise was combined with a low-calorie diet than when diet was used alone. Fifty-six Chinese children were followed for one year in an outpatient treatment program including parent participation, diet education, exercise management and behavior²⁰¹. Ninety-seven percent of participants were below pretreatment weight-for-length indices at one year. A 3-week program including diet and sports was

evaluated in a group of sixty-two obese children. Body mass, fat mass, leptin and insulin were decreased after the intervention in both males and females ²⁰².

Epstein and colleagues, ¹⁹⁹ examined the efficacy of three different types of exercise treatment programs for obese children. They found no differences in the weight maintenance of obese children participating in aerobic exercise, calisthenics and lifestyle during the first year of treatment. However, during the second year follow-up, the lifestyle exercise group maintained the weight loss while the other subjects participating in calisthenics and aerobic exercise gained significant amounts of weight. Gutin and others ²⁰³ evaluated the feasibility of implementing a physical training program in twenty-five African American females, 7-11 years of age. They participated in a standard aerobic exercise program at an intensity >70% of HR Max for approximately 30 minutes per session, 5 days per week. Eighty-eight percent of the subjects completed the program and attended classes 94% of the time. There was a small, but significant decrease in relative fat (1.4%). Significant improvements were also noted in aerobic fitness predicted via heart rate response.

Physical Training Improves Body Composition of Black Obese 7-11 yr Girls (Gutin, et al, Ob Res, 1995)

Variable	Lifestyle Pre (N=10)	Lifestyle 10 wk	Physical Training Pre (N=12)	Physical Training 10 wk
BMI (kg/m²)	26.8 (4.7)	26.7 (4.9)	27.9 (5.2)	27.1 (5.1)*
Fat (%)	43.35(8.8)	42.94 (9.1)	42.83 (7.9)	41.41(8.8)*
Fat free mass (kg)	28.14(4.1)	29.05(3.9)**	30.69 (7.3)	31.48(7.5)**
Peak Heart Rate (bpm)	187.2(11.8)	188.2(11.7)	194.8(17.1)	190.3(17.2)
Peak VO₂ mL/kg/min.	25.3 (4.7)	24.6 (3.2)	25.8 (4.9)	26.4 (6.6)
*p<0.05; **p<0.01				

Figuerola-Colon and colleagues ²⁰⁴ compared the results of two different types of hypocaloric diets in nineteen obese children of varying levels (147-231%IBW). An aerobic point system was used to prescribe duration and frequency of exercise at an intensity of 70% of maximum heart rate in both groups. Only 30% of the subjects following the very low calorie diet and 56% of the

subjects following the balanced calorie diet returned for 14.5 month follow-up. Only the VLCD subject group demonstrated a percent weight loss at 14.5 months, which was significantly lower than the baseline values.

Lipid profile adaptations associated with weight loss were observed in 56 mildly obese children after 6 months of diet only or diet plus lifestyle exercise ¹⁵. Total cholesterol was not affected by treatment but high density lipoproteins (HDL) were increased and triglycerides were decreased significantly at 6 months and again at 5 year follow-up in the diet plus lifestyle group. Becgue and colleagues ²⁰⁵ reported similar results using an exercise intensity of 60-80% Hrmax and progressively increasing durations of walking, jogging, swimming, and aerobic dancing over 8 weeks. Sothorn and colleagues published similar results using caloric restriction and moderate, progressive exercise ^{14, 74}.

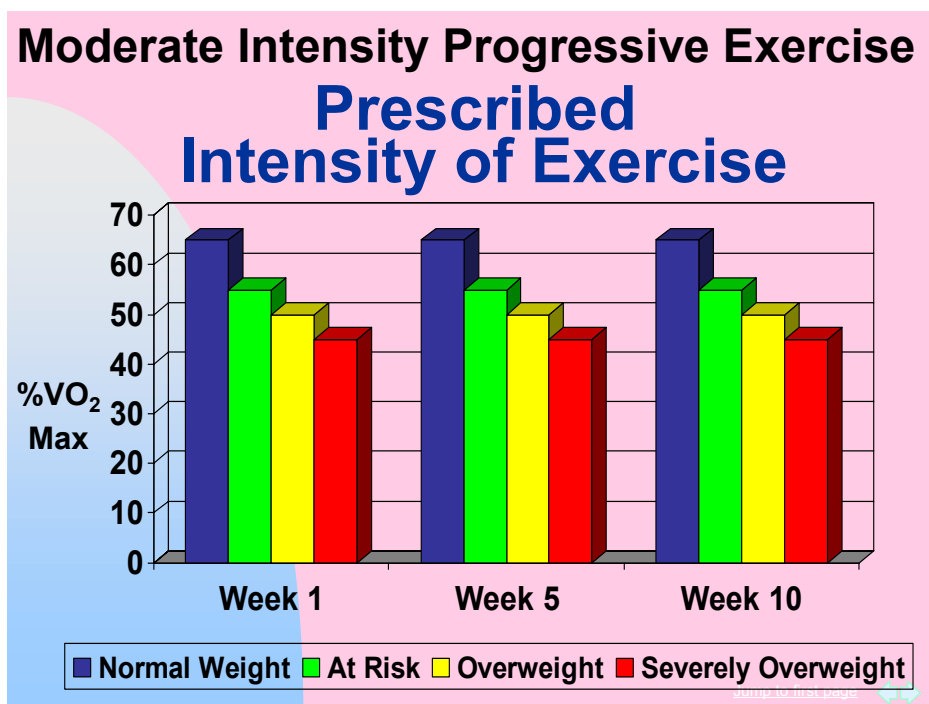
Structured Exercise and Maximal Oxygen Uptake (VO₂ Max) in Children:

Rowland ¹⁴⁴ suggested that when children are enrolled in physical training programs, and adult standards for intensity and duration of exercise are used, significant improvements in VO₂max generally occur. Recently, he reported that the differences between young premenarcheal girls and young adult women were minimal when the analysis was controlled by mass values that were adjusted allometrically ²⁰⁶. However, Armstrong (Armstrong, 1998 #780) reported that maturation levels significantly impacted VO₂max in 12 year olds. They also reported a significantly higher VO₂max in boys than in girls. However, Turley and Wilmore ²⁰⁷ observed no differences in sub maximal exercise between boys and girls aged 7-9 years. Racial differences have also been reported. Prepubertal black children were shown to have a VO₂max 15% less than that of white children ²⁰⁸. Few studies have examined changes in VO₂max in obese children and adolescents following exercise training ¹⁶⁰. Exercise alone has been shown to increase VO₂ max in female adolescents ²⁰⁹. The addition of body composition measures allows the expression of VO₂ max value relative to the lean body mass of the subjects. This was shown in previous studies to eliminate some of the bias associated with weight and the measurement of VO₂ max ⁴⁰.

Structured Exercise and Resistance (Strength) Training in Children:

Resistance training is defined as the use of a series of progressive resistance exercises to improve an individual's ability to exert muscular force against a resistance ²¹⁰. Investigators suggest that, if properly administered, resistance-training programs may not only be safe, but may also help reduce the risk of injury during other physical activities in children ^{133, 134, 210} (Pollock, 1998 #784). In addition, a safe resistance-training program will develop and prepare the muscles for sport and competition ^{37, 210}. The American Academy of Pediatrics (AAP) separates the terms resistance and strength training from the terms weight lifting, power lifting and body building (Pediatrics, 1990 #785) and supports properly supervised resistance training programs as safe methods for strength development in preadolescent children. The developing musculoskeletal system of the preadolescent child must be considered when designing resistance-training programs. The intensity and duration of an individual resistance exercise bout (set) must be appropriate to the level of maturity of the growing bones and muscles ¹³³. Several agencies have published resistive training guidelines for preadolescent children ¹³⁴. Trained professionals should consult these guidelines before designing a program specific to their patients' or students' needs. We have published results that the inclusion of regular resistance training in a program to prevent and treat pediatric obesity in preadolescent children is not only feasible, but also, safe and may contribute to increased retention at one year ^{133, 134}. Resistance training may be used safely to enhance the efforts to prevent and reverse childhood obesity and other chronic pediatric diseases in clinic-based interventions.

Based on the limited scientific information available, an appropriate exercise intervention for obese children should include realistic methods for increasing energy expenditure through motivational incentive sessions and educational techniques ^{8, 36, 51, 91, 133, 134, 142, 197}. Initially the intensity of exercise should be moderate or <55% VO₂ max. This will allow sustained durations of intermittent exercise adequate to promote a significant caloric deficit and a moderate improvement in physical fitness ^{170, 211} (Pollock, 1998 #784.)



The number of days per week (frequency) of exercise should gradually increase over the first 3 months of intervention in at risk, overweight and severely overweight children. The minutes per session (duration) of exercise should gradually increase over the first 3 months of intervention in at risk, overweight and severely overweight children.

Exercises for children should follow the guidelines of the American College of Sports Medicine^{37, 134} (Pollock, 1998 #784). Younger children, who are naturally active, should be given the opportunity to engage in enjoyable, intermittent exercise of varied intensities and durations with less emphasis on the improvement of aerobic capacity^{8, 129, 130}.

Initial Physical Activity Strategies by Medical History, Age & Weight Condition

Level	Age	Physical Activity Approach
Normal Wt Obese Parent	≤ 6	Family counseling, fitness education, free play, reduce TV, parent training
>85th BMI	7-18	Structured weight bearing activities, free play, reduce TV, parent training
>95th BMI	7-18	Alternate non-weight bearing activities, free play, reduce TV, parent training
>99th BMI	7-18	*Non-weight bearing activities, free play, reduce TV, parent training

***Close medical supervision required.**

[Jump to first page](#)



Comprehensive Programs using Diet, Exercise and Behavior Modification

The primary goal for the treatment of childhood obesity is healthy eating and increasing daily physical activity⁷³. However, the presence of medical complications, age and obesity level should be considered when developing a treatment plan using targeted reductions in high calorie, high fat foods along with exercise and behavior modification⁷³. Rossner (Rossner, 1998 #786) recently suggested that more aggressive treatment methods for obese children should be considered in order to prevent the low quality of life associated with adult obesity (Rossner, 1998 #786). However, several researchers continue to discourage calorie restriction in the treatment of childhood obesity (Quinzi, 1997 #787). Regardless, when calorie restriction is utilized in a pediatric weight management program, it should be accompanied by gradual increases in exercise and daily physical activity along with consistent behavior modification that includes nutrition and fitness education^{51, 135, 160, 212}. Figure 1 details a one-year plan for exercise in a clinical pediatric weight management setting.

In a recent study Ebbeling and Rodriguez²¹³ suggested that exercise may promote numerous metabolic benefits in obese children during diet-induced weight loss. Epstein and Goldfield⁵¹ report that exercise enhances the outcome of the short-term treatment of childhood obesity and encourages improvements in fitness when compared to diet-only approaches. Moderate

intensity activities of a non-structured nature will facilitate most of the disease prevention and health-promoting benefits of exercise, especially in children at risk for chronic diseases such as obesity^{6, 37}. Physical activity or exercise increases energy expenditure and, thus, caloric expenditure and improves resting metabolic rate through favorable changes in body composition¹²⁷. However, research is limited concerning the impact of significant weight loss in obese children through comprehensive approaches including calorie restriction and exercise.

C. Family Behavioral therapy

Family behavioral counseling is a vital part of the majority of published studies that show successful results. Listed below are behavioral techniques commonly employed in childhood overweight treatment programs:

Behavioral Treatment Strategies

- Monitoring of Diet and Activity
- Redirection & Give Choices
- Positive Attention
- Cue Elimination & Stimulus Control
- Limits Setting & Consistency
- Goal Setting & Action Planning
- Goal Review
- Modeling
- Relapse Prevention

Golan and colleagues recently demonstrated enhanced weight loss when the parents, as opposed to the overweight children, were targeted with counseling and education. The results follow:

Role of behavior modification with parents as exclusive agents of change²¹⁴ (Golan, et al, 1998)

Intervention: 1 year

- Group behavioral counseling targeting parents (no calorie restriction [CR]) or child (w/CR)

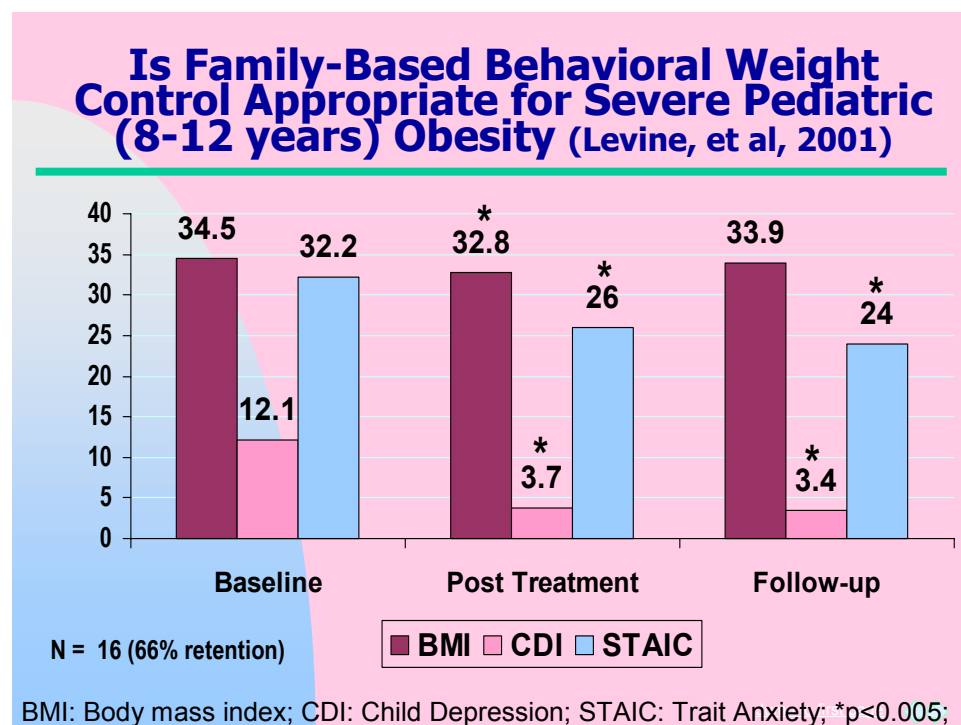
Outcome

- Weight loss = -14.6 ex; -8.4 control (<0.01)
- Reduction of stimuli food in the home
- No change in physical activity

Limitations

- Structured vs. non-structured diet
- Multiple agents of change due to records and weigh-in

Levine and colleagues recently examined the psychosocial changes associated with family based, behavioral childhood obesity treatment programs with the following results:



The results of this study indicated even after regaining weight lost initially, the depression and trait anxiety of overweight children remained improved.

D. Pharmacotherapy

According to the US Centers for Disease Control the following guidelines for integrating pharmacotherapy into childhood overweight treatment programs as follows:

Indications for the Use of Pharmacotherapy in Adolescents (USCDC; Dietz, 2003)

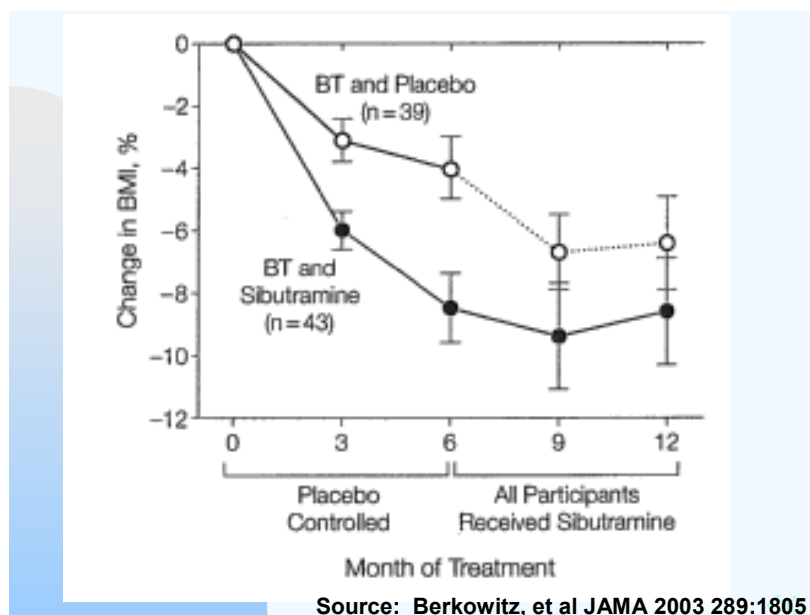
- Adolescent age group
- 200% of ideal weight
- Failure of more conservative therapy
- Relapse following protein modified fast

The following drugs are currently available for the treatment of overweight conditions during adolescence:

Drugs for the Treatment of Obesity (USCDC, Dietz, 2003):

- Orlistat – (Xenical) pancreatic lipase inhibitor
- Sibutramine – (Meridia) – serotonin reuptake inhibitor
- Phentermine – noradrenergic effects, MAO inhibitor

There have been only a limited number of trials exploring the use of pharmacotherapy in pediatric obesity treatment. Berkowitz and Wadden²¹⁵ recently observed a synergistic effect of adding sibutramine to a multi-disciplinary behavioral weight loss treatment intervention in adolescents.



Berkowitz and others recently published similar preliminary results using a comparable approach combining family, individual and peer group therapy in obese adolescents.

Local Studies:

Recently a version of the CTK model tailored to teens was implemented in 12-17 year olds as part of a FDA trial investigating the safety and efficacy of Meridia at the PBRC and the LSUHSC. Researchers observed optimal compliance and retention using this approach in combination with drug or placebo.

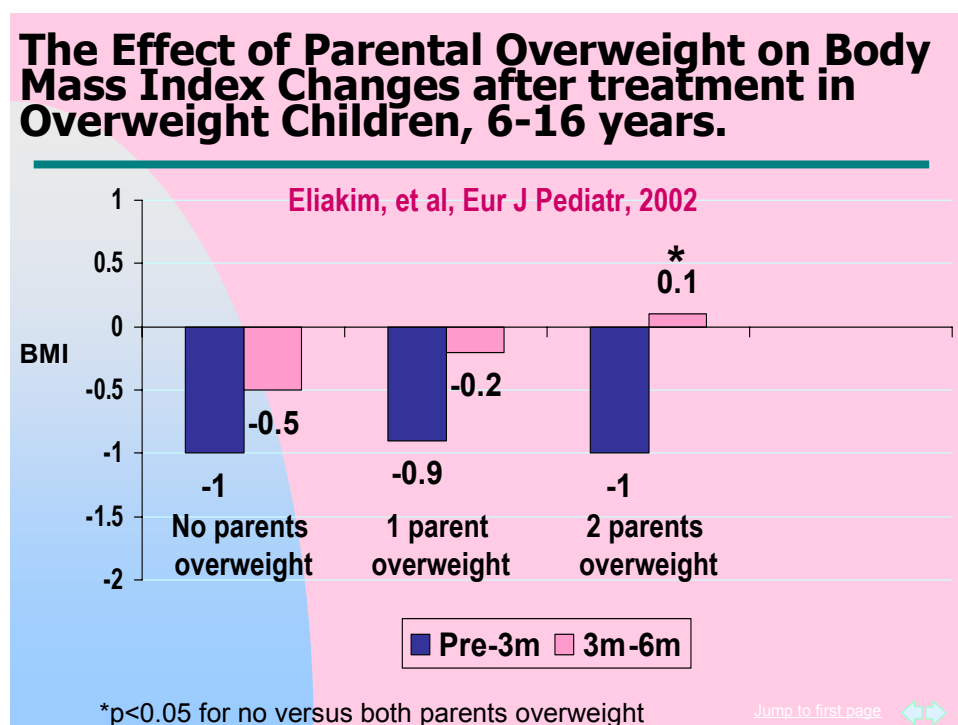
E. Weight Maintenance Following Weight Loss

Although successful weight loss is rare in overweight adults, research indicates that weight loss during childhood can be maintained into adulthood. Reducing the body mass index of overweight children of all ages has been shown to result in an improvement of chronic disease risk factors¹⁵. The long-term health benefits of family-based weight management programs in a clinical environment are well established in 9-12 year old overweight children¹⁹⁹. Benefits in lipid profiles and body composition have been documented in these children 10 years later during adulthood¹⁵.

Childhood Obesity Treatment Long-Term Studies			
Authors	Age	Intervention	Outcome
Epstein	6-12	Parent/child	-19.7% @ 10 yrs
Braet	9-12	Behavioral vs advice	-17.3 @ 4.5 yrs
Nuutinen	6-15	Group vs Individual	-11.7% @ 5 yrs
Epstein	6-12	Parental obesity	NS @ 10 yrs
Epstein	6-12	Exercise + diet	NS @ 10 yrs
Epstein	6-12	Lifestyle exercise	-15.3% @ 10 yrs

However, few studies have reported success in treating more severe conditions of childhood obesity. Long-term studies in older children with more severe overweight conditions are lacking. There is a need for tailored, developmentally appropriate obesity treatment programs for adolescents. Currently there is little information concerning the optimal obesity treatment program for teenage youth.

A recent study examined the contribution of parental obesity to the maintenance of weight loss in overweight children, 6-16 years of age with the following results:



This study demonstrated the importance of parental influence on the ability of overweight children to maintain initial weight loss.

Alternate Methods for Treating Obesity

Most short term studies in youth >12 years indicate that group behavioral approaches using dietary and physical activity approaches individualized to the age, medical and family history, current level of overweight, physical activity level, and diet history are most effective. Providing overweight children with opportunities to participate in a variety of physical activities in a nurturing, non-intimidating environment is recommended. Moderate aerobic exercise combined with high-repetition resistance training and behavioral modification may be most efficacious for improving body composition variables in overweight children. More prospective research is needed in order to identify effective nutrition strategies for treating overweight children especially in minority and low-income populations.

Recently programs that use peer modeling techniques were shown to increase acceptance, compliance and retention in several studies. Adolescent youth have unique needs. Strategies that encourage parents to positively alter the home environment while providing emotional and physical support to overweight teens may enhance weight loss efforts. Tailored, family and peer group behavioral interventions have not been systematically evaluated in obese adolescents in an after school-based setting under randomized and controlled conditions.

A limited number of short term trials illustrate that pharmacotherapy, in conjunction with behavioral strategies, has a positive effect on several health outcomes in overweight teens.

Refer to D. Pharmacotherapy above

Surgery in Adolescents

There is a dearth of data on the impact of adolescent bariatric treatments, and the majority of studies on this topic are retrospective in nature. Bariatric surgery for adolescents has not been formerly recommended due to the lack of sufficient data on the topic²¹⁶. Nonetheless, adolescents with clinically severe obesity have been provided surgery as a viable treatment option. In 1994, Rand and Macgregor interviewed 34 adolescents aged 11 to 19 years who were 6 years post-surgery. Preoperative BMI for these patients was 47 kg/m², and was 32

kg/m² at the time of follow-up. Seventy-three percent of the patients had 50% weight loss. The average weight regain was 9 kg. The majority of patients had RYGB (34) and four had VBG. The mean age at time of surgery was 17 years. Growth rate appeared unaffected, and health and psychosocial improvements were reported by most. Only 13% reported taking nutritional supplements as prescribed, and adherence to exercise and dietary recommendations was poor. Overall, 85% of the sample reported that they would “definitely” have the surgery again if they had an opportunity to go back and remake their initial decision. In another study, follow-up data on gastric bypass outcome was evaluated among ten adolescents²¹⁷. The average weight for the sample preoperatively was 148 kg and the mean weight loss was 53.6 kg. Postoperative recovery was uneventful in all adolescents, and micronutrient deficiency was the most commonly reported late complication. All of the three women who became pregnant after surgery had weight regain, however, the pregnancies were uncomplicated. Overall, the authors concluded that bariatric surgery is well tolerated in adolescence and produces similar results as in adulthood. Dolan and colleagues prospectively collected data since 1996 on adolescents who received laparoscopic adjustable gastric banding (LAGB) (Dolan, 2003 #398). Seventeen patients with a mean age of 17 years received the surgery. Two of the patients experienced complications (i.e., a leaking port and slipped band). Preoperative BMI was 44.7 kg/m², and at 24 months BMI was 30.2 kg/m². Over 75% of patients lost a minimum of 50% of their excess weight. The authors reported that LAGB is a safe and effective treatment for severely obese adolescents, and may be a preferred method in this population given that the procedure is reversible. In another study, the authors reviewed a 20 year-old database on bariatric surgery in adolescents (Sugerman, 2003 #158). Of the 33 adolescents in the registry from 1981 to 2001, one received horizontal gastropasty, two received VBG, 17 received standard gastric bypass (two of which were laparoscopic), ten received long-limb gastric bypass, and three received distal gastric bypass. Mean preoperative BMI was 52 kg/m², and the mean age at time of surgery was 16 years. Follow-up at 14 years found that 61% of excess weight lost was maintained. No operative deaths were reported, however, two patients died two years and six years postoperatively to conditions unrelated to the surgery. Early and late complications, as well as revisional surgeries approximated the prevalence found in the adult literature. Five of the patients had regained all weight by 10 years post-operation, however, significant weight loss was maintained in the majority up to 14 years post-surgery. None of the patients displayed impaired sexual or physical maturation, and remission of comorbid conditions and improved psychosocial functioning were reported. The authors concluded that bariatric surgery in adolescence was safe, promoted significant weight loss, and improved comorbidities,

socialization, and self-image. In a recent article Garcia, Langford, and Inge (2003)²¹⁸ reviewed the application of laparoscopic surgery in adolescents. They report that no prospective, randomized studies comparing the efficacy of bariatric surgery to other conventional methods have been conducted. Despite the scarcity of research, outcome reports are promising. The authors encourage the use of behavioral management programs, and meeting the psychosocial and emotional needs of adolescents undergoing bariatric surgery. Additionally, the authors address the need for systematic data to evaluate the uses of RYGB versus adjustable gastric band in this population. Specifically, adjustable gastric bands require no partitioning of the stomach thus reducing nutritional deficits, are reversible, and bands can be adjusted for times of pregnancy. However, the short and long-term weight loss with the gastric banding is not as promising, and the deterrent to developing maladaptive eating patterns is not as present as with the gastric bypass procedure.

VI. Settings for Weight Management

A. Medical

See Weight Management Techniques

B. School

(see also section IV. Weight Management Goals A. Prevention of Weight Gain in Children: School based Studies)

Comprehensive school-based programs

Gortmaker and colleagues¹²⁵ and Mo Suwan¹⁹⁵ evaluated diet exercise interventions in school-based settings. The interventions successfully prevented an increase in BMI in the female students but not the male students. Conversely, Donnelly¹⁹⁶ observed no change in the BMI of students participating in a nutrition and physical activity program. In two studies, Robinson and others demonstrated that targeting the family with interventions to reduce TV watching²¹⁹ and after school African dance programs (GEMS study) results in reduced BMI, TV viewing, and snacking in front of the TV. In a study of Native American youth, a program called Pathways was shown to promote reduced fat intake and improved food and health related knowledge, but failed to show a significant reduction in BMI²²⁰. The following table details the impact of school-based studies on weight status in children:

Nutrition and Physical Activity Strategies in School-Based Settings			
Study	N	Age (yrs)	% Obesity (BMI)
Planet Health	1,295	11-14	-3.3% Ex/+2.2%C*
Robinson, 1999	200	8-10	-0.45**
Donnelly, 1996	--	8-11	No change
Mo Suwan, 1998	292	4-5	12.2%*
CATCH	5,106	9-10	No change
GEMS	61	8-10	Trends***
Pathways	1704	8-11	No change****
*girls only **between groups $p < 0.002$ *** Significant reduction in TV and snacking in front of TV **** Significant reduction in fat intake and food and health knowledge			

Increasing Physical Activity in School Settings:

Motivating young, normal weight and physically active children to maintain activity patterns may be less challenging than increasing patterns in already overweight older children. In a study by Javernick, he suggests that just monitoring children during free play does not encourage the participation of heavier children. Heavier children are often ignored, ridiculed¹³² and often choose indoor, sedentary activities to escape negative activity situations¹³¹. Therefore, encouraging the sedentary, overweight child to participate in physical activity is difficult. In addition, even mildly overweight children have a decreased tolerance to exercise; movement may be uncomfortable and, in some cases, painful^{36, 48, 91}. Prior failure to motivate and maintain increased physical activity in overweight children may be attributed to inappropriate physical activities^{91, 133, 134} and a lack of physical opportunities for overweight children in the traditional school environment¹³¹. In addition, emotional problems may further inhibit successful motivation of sedentary overweight children^{3, 91, 132}. Researchers suggest that a task-orientation approach to physical activity and sport that includes individual goal setting may be advantageous for overweight children²²¹. Outcome goals such as winning or scoring are thus replaced with individual self-referenced criteria and mastery of individual skills. Teachers are encouraged to focus the student's attention toward achieving personal goals as opposed to competitive goals.

Daily physical activities should alternate between team sports and individual activities to ensure equal opportunity for all children regardless of size or ability (Table 1).

Some researchers suggest that forcing children to participate in structured exercise may actually negatively impact physical activity patterns later in life ¹⁴⁶. This is especially true in overweight children who may already feel inadequate due to a lower tolerance to exercise. All young children, regardless of body size, are easily distracted and incapable of focused activity for long periods of time ^{74, 129, 130}. This contributes to the sporadic nature of their physical activity. Adults can engage in long duration exercise easily because of their enhanced ability to concentrate and participate without much mental effort. Therefore, physical activities targeting young children in general and, overweight children specifically, should be intermittent consisting of short time frames of vigorous activity alternating with longer periods of low intensity activity (Table 2).

Overweight children will engage in activities they believe they can accomplish and master. Conversely, they will avoid activities that draw attention to their disabilities. Expose overweight children to as many different types of movement activities as possible in a non-intimidating and nurturing environment. Lastly, explain to the parents of both normal and overweight students that all types of physical activity improves fitness and burns calories. If children self-select activities they enjoy they are more likely to perform those activities more often and for longer periods of time. Provide opportunities for children to play outdoors as often as possible. Better yet, encourage parents to play outside with their children---the family that plays together stays healthy together.

Table 1: Alternative Individual Goal Based Activities for Elementary School Children:

Traditional Physical Education and Sports	Individual Goal-based Alternatives
Ice, Field or Roller Hockey	Figure skating, Inline or roller skates, cross country skiing
Cheerleading, Dance team	Aerobic dancing or Strength Circuit Training. Modified Yoga
Football, Soccer or Basketball	Martial arts, Kickboxing, Tai Bo
Track & Field	Outdoor Cycling, Scooters, Fun Walk/Runs or

	Nature Hikes, Tai Chi
Baseball, Softball or Volleyball	Archery, golf, croquet or horseback riding
Water Polo	Swimming/diving skills
Swim Team Relays	Snorkeling

Table 2: Top Ten Tips to Increase Outdoor Physical Activity in Overweight Children.

1. Consider organizing activities that alternate students from sitting to standing positions to give overweight children a chance to “catch their breath” and rest their ankles and knees.
2. Limit vigorous activities to 5-10 minutes alternating these with easier, less intense activities of longer duration.
3. Pick teams this fast and efficient way: Tell the children to make a single file line behind you. Give them alternating colors to designate their team affiliation, such as red, blue, red, blue and so on. Never pick captains and then allow them to pick the team members.
4. Set up a musical aerobic circuit. Children move from one station to another and perform aerobic dance moves for 1-2 minutes. For example: Station 1: Twist, Station 2: March in place, Station 3: Skip rope, Station 4: Modified jumping jacks (side-jacks).
5. Consider setting up stations for strength and flexibility training or mark out a fitness trail that includes stops for stretching or doing strength exercises. Make sure the exercises are appropriate for the child’s physical development and body size.
6. Limit the frequency and duration of high impact activity such as jumping or running up hill. Even normal weight children can experience joint overuse injuries; overweight children are especially at risk.
7. Spend time teaching the students about their different muscle groups while they learn appropriate exercise technique. This provides important physiologic feedback, which helps motivate them to repeat the activity and understand what is safe and effective exercise.
8. Spend a class teaching the students about posture, balance and body alignment while they perform stretching exercises. This will help especially overweight children choose appropriate movement activities.
9. Use an outdoor activity to teach the students about their body’s metabolism. Explain how their body’s can go slowly for long periods of time but that if they go very fast they will run out gas quickly. This will help especially overweight children understand their limitations.

10. Never allow overweight children to be verbally abused by other children. Provide appropriate consequences to bullies and, if necessary, consult the child's parents or school principal.

VII. Population Targets for Weight Management

Discussed in Introduction

VIII. Costs Associated with Obesity and Treatment

The Fiscal Impact of Treating or Preventing Obesity

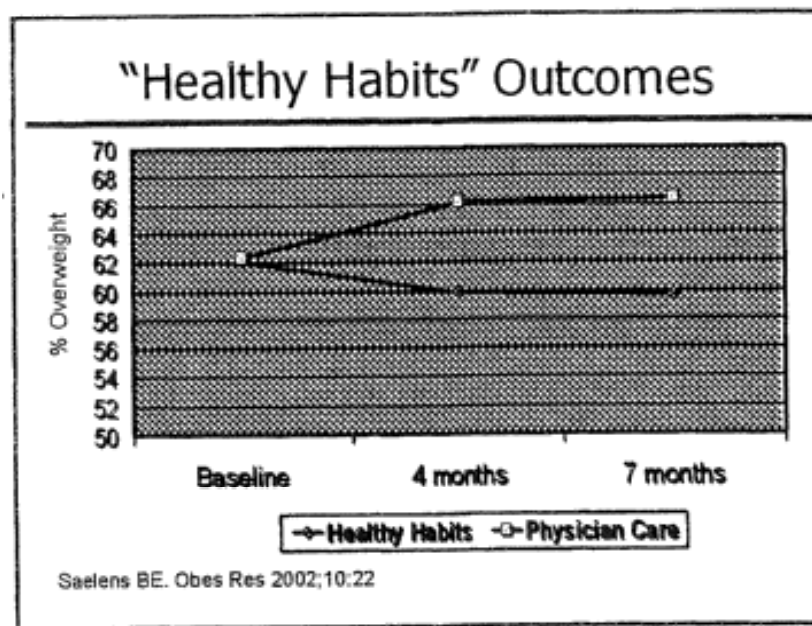
- A. The economic burden of obesity-associated illness during childhood has increased from 35 to 127 million (43%) in the past 2 decades¹⁸⁷.
- B. Costs of diseases associated with obesity, including diabetes mellitus, hypertension, heart disease, stroke, gout, arthritis and cancer exceed 100 billion dollars per year in the U.S., about 8% of the national health care budget²²².
- C. The cost to treat overweight children in a clinical setting ranges from \$1,200 to 11,000 per year. Group treatment programs are shown to be more cost-effective than mixed (individual plus group) therapy²²³. In a recent study, the use of a school-based nutrition and physical activity intervention, Planet Health, was shown to be far less expensive than the cost associated with treating overweight children²²⁴.

IX. Results of Weight Management on Co morbid Conditions

Discussed in Introduction and Weight Management Goals and Techniques

X. New Innovations

Recently a physician based, individual counseling program including nutrition and physical activity education was shown to be superior to a standard care approach in overweight teenagers. The results are detailed below:



Motivational interviewing, commonly used in substance abuse treatment models, has recently been proposed, tested and recommended for use in individual clinical management and childhood overweight treatment programs.

A book designed to be used with a local pediatrician or family physician targeting the parents of overweight children, called Trim Kids, (Harper Collins, 2001)²²⁵ was recently published by researchers from LSUHSC and the PBRC.

- The approach is based on over 18 years of clinical and research experience and is shown to be effective in reducing the weight status and improving the metabolic profile of overweight children in several clinical outcome trials.
- It has been endorsed by several experts in the field and has been featured in major scientific publications and national media. Trim Kids is currently being utilized in several physician offices, hospitals, recreation centers and medical centers nationwide and continues to be used in treatment programs at the LSUHSC and PBRC.
- Currently it is being implemented in over 30 school based health centers in the state of Louisiana (Educational training was provided free of charge by LSUHSC and PBRC faculty. The PBRC and Blue Cross/Blue Shield insurance provided the copies

of training materials at no charge. Educational materials valued over \$25,000.00 were donated by officers of Committed to Kids, LLC).

- The physical activity component described in Trim Kids is currently being implemented in several school-based trials including the NIH funded TAAG and Wise Mind studies.
- Randomized, long term studies are needed to confirm the results of the one-year clinical outcome trials utilizing the Trim Kids and Committed to Kids approach.
- The Trim Kids (Committed to Kids) program was featured in a Louisiana Public Broadcasting Systems (LA PBS) Documentary entitled, "Kids Trying to Trim Down". The program low to middle class families and presents the nutrition, physical activity and behavioral content in an entertaining, easy-to-understand, visual format. The one-hour documentary has aired statewide, nationally and was nominated for a Peabody Award.
- Due to the overwhelming success of the LA PBS documentary, they are currently filming a 6-part series that details the Trim Kids (Committed to Kids) program exclusively.

Recently, the contribution of early nutrition to developing fetuses and infants has taken center stage in efforts to prevent the early onset of obesity. Programs are being developed that target pregnant women with a family history of obesity in efforts to both prevent excessive weight gain during pregnancy and improve nutritional intake. Programs to encourage breastfeeding as a protective method are also encouraged along with sensible nutrition and physical activity recommendations for toddlers, preschoolers and elementary school-aged children. A sample physician handout follows (See Appendix for final version in Gerber Pediatric Basics):

Putting Research Into Practice: by Melinda S. Sothorn, PhD, CEP.

Obesity results when susceptible (genetically pre-disposed) children are placed in "adverse" environments especially during critical developmental periods: 1) pregnancy or early infancy, 2) 5-7 years and 3) adolescence. In fact, more often than not, adult obesity originates during the early childhood years. Studies illustrate that babies with slow fetal growth or those born with low birth weight are at increased risk for obesity and metabolic disease. There is growing evidence that rapid childhood weight gain may be equally as predictive. And, even though research supports the concept that genetic make-up determines risk; it is the environmental experience that ultimately manifests obesity and

diabetes. The current environmental experience of young children includes few opportunities for physical activity and an overabundance of high calorie foods. Sedentary lifestyles and poor nutrition challenge children who are genetically at risk for diabetes and heart disease, especially those with early environmental factors such as slow fetal growth and low birth weight. Obesity is a logical response to this challenge. These factors fuel the growing epidemic of childhood obesity, which is the most critical challenge facing medical professionals today. However, since this is a relatively new phenomenon, most professionals—including doctors—feel ill equipped to address this growing problem.

Typically, children begin gaining unnecessary weight between the ages of three and seven years. By then, they are spending a good deal of time sitting behind a desk at school. After school, they might play video or computer games, or watch several hours of television. Meanwhile, they may be eating fast food 3-6 per week (the national average). And, it only takes a few extra pounds on a youngster to make his clothes feel uncomfortable, his movement restricted, and his enthusiasm for physical activity plummet. When he slows down, weight gain speeds up. The physical repercussions are not easy to recognize except when he exerts himself during active playtime. Then, he is likely to become short of breath, overheated, and sweat heavily. At this point, overweight children may begin to feel inadequate at sports or other physical activities leading to a more sedentary lifestyle, which exacerbates weight gain. Other children may tease them relentlessly and they may turn to food for comfort, which causes more weight gain. Participation in physical activities becomes even more difficult and indoor activities such as television and computer games replace outdoor play. This is a vicious cycle that must be stopped.

Pediatricians can help parents to stop the vicious cycle on all fronts by guiding them to make changes in the home environment that will promote healthy eating and increased physical activity. In fact, the family environment has the greatest impact of all on children's weight gain. The flip side of this fact is: The family environment also has the greatest impact on the child's ability to achieve a healthy weight and build a lifetime of healthy habits. But it doesn't happen overnight. Change must come gradually for parents to experience success. Establishing just one nutrition and physical activity goal per pediatrician visit can go a long way to creating a nutritious, physically active home

environment. Providing brief information on strategies to help achieve these goals takes only a few minutes:

Visit One –

Nutrition Goal: Replace unhealthy snacks with fruits and vegetables.

Strategies: Allow infrequent consumption of non-nutritious foods away from the home. Gradually reduce fast food consumption to less than one time per week. Bring children along when shopping. Have them select one fruit and one vegetable to try for the week and skip the candy, cookie and soft drink aisle. Purchase bottled water instead of soda. Include kids in meal preparation. Encourage at least 3 bites of each food on the plate. Grade the foods, A, B, C or F. High scoring veggies are served again and often.

Physical Activity Goal: Decrease TV/computer time.

Strategies: Create an imagination station with safe indoor, active toys in the corner of the family room. Turn on the stereo instead of the TV; teach your child to cha cha, tango or waltz. Let your child take a 5-minute physical activity break every 30 minutes of TV, computer and even homework! Do commercial boogie – dance or stretch during commercials.

Visit Two –

Nutrition Goal: Decrease eating in front of the TV/computer.

Strategies: Establish family dinners on the weekend. Use the china and make it special. Gradually include weekdays. Eventually restrict all eating and drinking (except water) to the kitchen counter, table or dining room. Serve children an appropriate portion size (usually about ½ cup) of each food prepared. Children will eat more if you serve them more.

Physical Activity Goal: Increase weekend physical activity.

Strategies: Create an environment for play outside. Purchase a large plastic tub and fill with balls, jump ropes, skates, games, etc. Play a game of family football during the first and third quarter of televised games—you'll still get to watch the 4th quarter to see who wins. Dedicate at least ½ day each weekend to outdoor family fun.

Visit Three:

Nutrition Goal: Increase breakfast.

Strategies: Discourage snacking after dinner so children will be hungry when they wake up. Plan breakfast the night before and make it attractive. Teach children that it is okay to leave food on their plate. This teaches them to self-regulate and not to overeat.

Physical Activity Goal: Increase opportunities to develop muscular strength, endurance and flexibility.

Strategies: Expose young children to as many activities as possible in a positive, nurturing and non-intimidating environment. Provide opportunities for young children to safely climb, run and jump to help develop muscle strength and bone density. Don't impose adult exercise goals, programs or equipment on young children, who have immature metabolic systems. Their bodies are better designed for short bursts of intermittent active play.

The Ultimate Parent Tip: Stop the nagging. Don't draw attention to negative behaviors. Rather, spend your energy praising your child when he chooses healthy foods or physical activity. When your child selects an unhealthy snack or heads for the TV, try to re-direct and give choices: Do you want strawberries, carrots or melon for your snack? They can't choose what's not offered. Would you like to go outside and play or tidy your room? No "brainer": If you let him, he will play.

Efforts are also underway to encourage healthy eating and increased physical activity in children whose mothers use the WIC programs. Community-based studies have recently been completed or are currently underway including ¹⁶⁸:

- CardioVision 2002 in Minnesota and the 5 state overweight intervention program,
- FitWIC, designed for children participating in the Supplemental Feeding Program for Women, Infants and Children.

Several community-based interventions aimed at youth which include a measure of weight status are currently planned or in progress. For example:

- The Kahnawake Schools Diabetes Prevention Project is an 8-year intervention that targets a small community of approximately 7,000 Mohawk people near Montreal, Canada.

- One pilot study organizes school and community coalitions to facilitate environmental changes that will increase walking and biking to school among youth in Chapel Hill, North Carolina;

One pilot study targets preschool children in the childcare setting and involves social marketing and collaboration with community organizations and food establishments in a rural New York community¹⁶⁸.

Internet-based approaches:

Recently researchers from the PBRC designed, implemented and tested an internet-based weight management approach in African American girls and their mothers in a clinical setting. Internet based approaches are currently being implemented by researchers from the PBRC in a school-based, environmental intervention called Wise Mind in parochial schools in the Baton Rouge area.

(See also section XI. Louisiana Programs for more information on Hip Teens and Wise Mind)

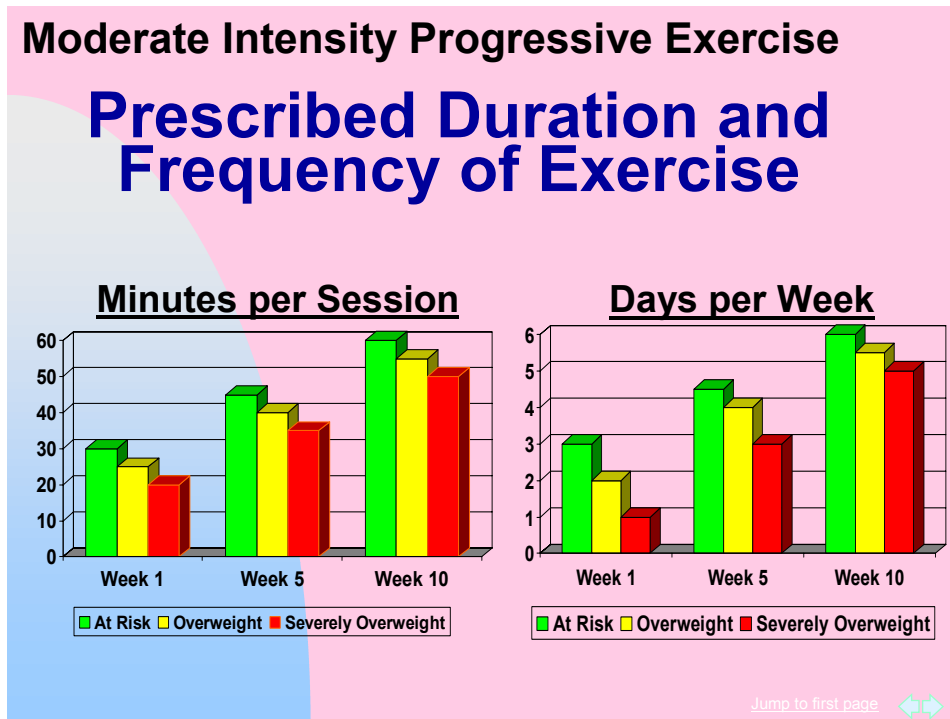
XI. Louisiana Programs

Structured Exercise, Physical Activity Education And Caloric Restriction In Outpatient Clinical Settings in New Orleans and Baton Rouge

Researchers at the LSUHSC and Pennington Biomedical Research Center have evaluated a program that provides quality medical, nutritional, psychosocial, and exercise intervention to overweight and obese children along with their families in a weekly outpatient clinical setting⁸ (Sothorn, 1999 #791). The program is unique due to its integrated, four-level approach that encourages short-term (12-week) goal-setting, quarterly feedback and motivational techniques to improve health behaviors^{8, 91, 134}. During the one-year program participants and their families attend weekly two-hour comprehensive sessions. During these sessions, patients receive medical supervision, nutrition instruction, physical activity education, exercise activities and behavior modification. The medical nutrition therapy consists of weekly physician monitoring, individual diet prescription and quarterly comprehensive evaluations^{8, 212}.

The structured exercise protocol and physical activity education includes a Moderate Intensity Progressive Exercise Program (MPEP) for children with increasing levels of obesity based on

Social Cognitive Theory^{8, 91, 133} (Bandura, 1986 #792). The approach includes not only guidelines for exercise frequency, duration and intensity but also a series of 52 weekly dynamic and interactive group sessions that promote increased physical activity and improved body movement awareness^{8, 91, 160}



The program also includes specific recommendations for type or modality of exercise based on the individual overweight level and physiologic function of the patient^{8, 36, 48, 49}.

Children at Risk for Overweight Conditions (>85th BMI), 7-18 Years

- **Limit access to TV/video/computer**
- **Recommended Aerobic Activities:**
 - Weight-bearing such as brisk walking, treadmill, field sports, roller blading, hiking, racket ball, tennis, martial arts, skiing, jump rope, indoor/outdoor tag games.
 - *NOTE: Guidelines should be readjusted every 10-15 weeks based on evaluation results.*
- **Parent training and fitness education**
- **Pacing Skills**

Sothorn, 2000; 2001

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Overweight Children (>95th BMI), 7-18 Years

- **Limit access to TV/video/computer**
- **Recommended Aerobic Activities:**
 - **Non-weight-bearing such as swimming, cycling, strength/aerobic circuit training, arm specific aerobic dancing, arm ergometer (crank), recline bike, and interval walking.***
 - **Walking with frequent rests as necessary. Gradually work up to longer walking periods and fewer rest stops.*
 - *NOTE: Guidelines should be readjusted every 10-15 weeks based on*
- **Parent training and fitness education**

Sothorn, 2000; 2001

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Severely Overweight Children (>99th BMI), 7-18 Years

- **Limit access to TV/video/computer**
- **Recommended Aerobic Activities:**
 - **Non-weight-bearing only such as swimming, recline bike, arm ergometer, seated (chair) aerobics and seated or lying circuit training.**
 - *NOTE: Guidelines should be readjusted every 10-15 weeks based on*
- **Parent training and fitness education**
- **Other emotional and dietary concerns must be addressed during treatment.**

Sothorn, 2000; Myers, et al, 1998; Strauss, 2000; Barlow & Dietz, 1998, von Almen, 1985

Exercise instruction is conducted at each visit by a clinical exercise physiologist and includes fitness counseling. The exercise activities correspond with the group's physiological condition of obesity and ability to comprehend, synthesize and apply health and fitness information to daily life situations. The muscular strength and endurance and flexibility exercises are illustrated in detail in the student workbooks and also demonstrated in exercise videos^{133, 134}. The MPEP is also prescribed for use at home and subjects are encouraged to select a variety of aerobic activities that they enjoy^{4, 8, 160}. Exercise record cards, listing the frequency, duration, and type of exercise, are kept by each subject and checked at weekly clinic meetings.

The treatment program has been evaluated in several investigations⁸ (Sothorn, 1999 #791)^{36, 48, 91, 133, 134, 160, 212 16, 49, 135}. The weight loss and body composition results of the initial eighty-seven participants are shown in Table 3. Significant reductions were observed from baseline to one year in weight, BMI and %fat with no decrease in lean body mass ($p < 0.001$; Table 3). The comprehensive integrated, four-level approach is successful because of several factors: 1) The program features entertaining nutrition and exercise education for children, and parent-training methods in short, interactive sessions; 2) The improved exercise tolerance due to the weight loss promotes increased physical activity; and 3) The program team provides consistent feedback. The patients and their families receive results and updates every three months. Most

importantly, the program is conducted in groups of families and the parents' participation in exercise class is strongly encouraged.

The LSUHSC pediatric obesity clinical research section evaluated the Committed to Kids multi-disciplinary program to treat obesity in children, less than 8 years of age by analyzing data collected from the Children's Hospital Weight Reduction Clinic, the Earl K. Long Weight Management Clinic and the Lafayette General Weight Management Program ²²⁶.

The effect of diet, exercise and behavior on weight, %IBW and BMI.

Twenty-three children less than 8 years of age were enrolled. Of the twenty-three children, sixteen (70 %) successfully completed the one-year study (Table 5). Results follow:

Table 5: SELECTED VARIABLES AT BASELINE, 10-WEEK AND 1-YEAR*.

	Baseline		10 weeks	1 year
Variable	N	Mean \pm SD	Mean \pm SD	Mean \pm SD
Weight (kg)*	16	50.01 \pm 6.60	43.93 \pm 6.17	48.30 \pm 8.37
Height (cm)	16	129.78 \pm 8.	131.33 \pm 8.67	134.95 \pm 8.16
IBW (%)**	16	184.69 \pm 27.	157.19 \pm 27.75	159.25 \pm 26.70
BMI (kg/m ²)***	16	29.75 \pm 3.75	25.58 \pm 3.84	26.50 \pm 3.99

*p< 0.054; **p< 0.009; ***p< 0.011 (repeated-measures ANOVA, Duncan's multiple range test)

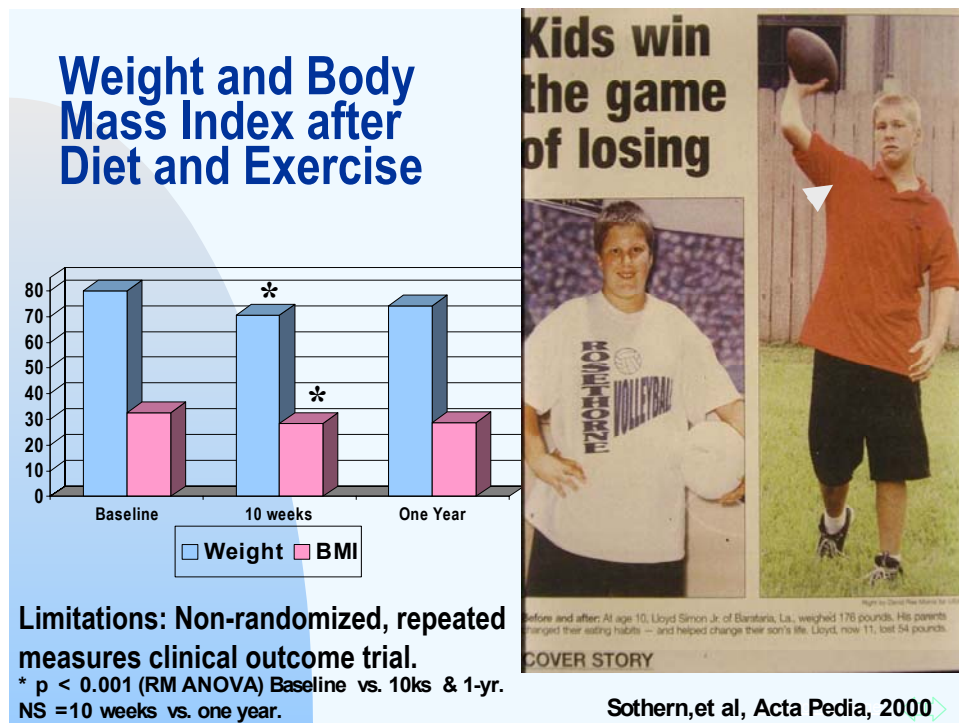
The data were analyzed using repeated-measures. This analysis revealed significant treatment effects for total body weight ($p < 0.054$), percent ideal body weight ($p \leq 0.009$), BMI ($p < 0.011$). Furthermore, in %IBW and BMI the 10-week values were significantly lower than baseline values ($p < 0.05$). However, the differences in the 10-week values and the 1-year values were not statistically significant. The mean increase in height from baseline to one year for the 16 children was 5.17 cm.

Exercise and Caloric Restriction: Impact on Growth Velocity

Fifty-six subjects were enrolled in the comprehensive program of protein-sparing modified fast (PSMF), nutrition education, MPEP and behavior modification ²¹². After 10-weeks there was a

significant average weight loss of 9.4 kg ($p < 0.0001$). At one year thirty-five subjects (62.5%; 12M/23F) reduced initial BMI from 32.7 ± 7.0 to 28.4 ± 6.6 at 10 weeks and 28.8 ± 5.7 at 1-year follow-up ($p < 0.0001$; Table 4). The changes in weight, height, percent IBW, and percent body fat for the group completing the 1-year program are shown in Table 5. The average height in cm was 154.2 at baseline, 155.5 at 10 weeks and 158.4 at 1-year follow-up. The increase in height over the 1-year period was statistically significant ($p < 0.0001$; Table 5). Post-hoc contrasts showed a significant increase in height from baseline to 10 weeks ($p < 0.0001$), and to 1-year follow-up ($p < 0.0001$).

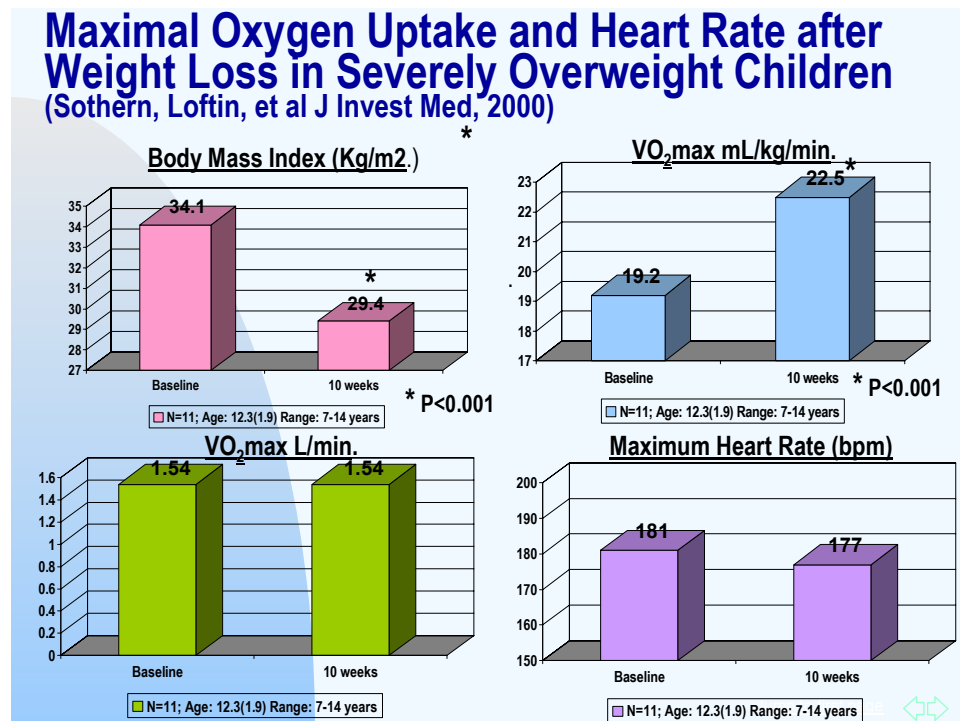
Ten of 12 boys showed height increments and growth velocities during the year that were normal for their respective chronological ages. However, two subjects showed a growth velocity below the 3rd percentile for their chronological age. Eighteen of the 23 girls had heights and growth velocities in the 1-year interval that were normal for their respective ages. Four subjects showed growth velocities below the 3rd percentile, but all four had heights at the end of the study that were normal for the height of an adult North American female. This study suggests that, in some patients, severe caloric restriction may negatively impact growth velocity even in the presence of exercise and close medical supervision²¹². Therefore, medical professionals should only prescribe very low calorie diets in patients with severe obese conditions or other serious medical concerns that require weight loss. Its use in patients with short stature should be delayed until the patient reaches his or her full growth potential unless the excess weight presents a life-threatening situation. The results are illustrated in detail below:



Exercise and Caloric Restriction: Impact on VO_2 Max:

VO_2 max values were obtained at baseline and 10 weeks using cycle ergometry and indirect calorimetry¹⁶⁰. Eleven subjects entered the weight-management program and completed the initial 10 weeks. The mean attendance was 91% and exercise, measured by self-report of volume (total minutes of exercise each week), exceeded recommended amounts in all subjects. There was a significant average weight loss of 8.1 kg ($p < 0.0001$; Table 6). The average height increased significantly from 157.0 ± 9.0 cm at baseline to 158.1 ± 9.0 cm at 10 weeks ($p < 0.005$; Table 1). The mean BMI decreased significantly from 34.1 ± 4.8 to 29.4 ± 5.8 ($p < 0.001$; Table 6). During the 10 week period all of the subjects achieved a lower category of obesity; i.e. from severely obese to obese, from obese to overweight, and from overweight to normal weight. The increase in relative VO_2 max mL/kg/min. from baseline (19.2 ± 3.0 mL/kg/min) to 10 weeks (22.5 ± 5.8 mL/kg/min) was significant ($p < 0.001$; Table 6). However, when expressed in absolute values (liters/minute), the baseline measure (1.54 ± 0.26 L/min) did not differ significantly from the 10-week measure (1.54 ± 0.29 L/min). Volume of carbon dioxide (VCO_2), respiratory exchange ratio (RER) and heart rate (HR) max were not significantly altered. Total test time was unchanged. Power output was increased slightly, but not significantly. In this study VO_2 max increased significantly in eleven subjects when expressed relative to body weight

(mL/kg/min). However, when expressed in absolute values (L/min), there was no change in VO_2 max indicating that VO_2 max relative to body weight increased due to the significant loss of body weight.



Exercise and Caloric Restriction: Impact on Resting Energy Expenditure:

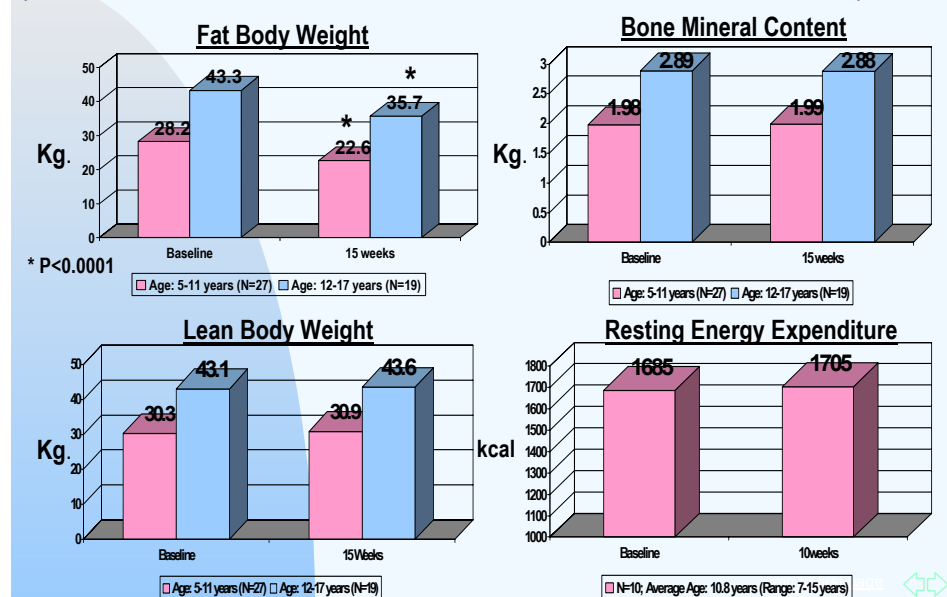
Ten children (4 male, 6 female; 7 Caucasian, 3 African-American) 7-17 years of age (10.8 ± 1.9) were evaluated at enrollment and at 10 weeks for resting energy expenditure [REE]¹³⁵. Subjects were instructed to refrain from physical activity for 12 hours and to fast for 4 hours prior to testing. The test values were obtained during the late hours of the afternoon at both baseline and 10-week evaluation. Expired gas was collected for 30 minutes after subjects were resting in a supine position for 15 minutes. Data for the first 5 minutes were discarded.

Average initial anthropometric measurements of the subjects after the 10-week intervention phase are presented in Table 7. These values were compared to those obtained at 10 weeks (Table 7). There was a significant average weight loss of 8.4 kg ($p<0.0002$; Table 7). The average height increased significantly from 149 ± 12.0 cm at baseline to 150.0 ± 12.4 cm at 10 weeks ($p<0.001$; Table 6). The mean percent IBW decreased significantly from $181.7 \pm 27.0\%$ to

159.1± 22.86% ($p < 0.0002$; Table 7). The measurements of relative body fat (%), as calculated by skin fold thickness, decreased significantly from 48.9 6.9% to 41.0 8.0% ($p < 0.001$; Table 7). Lean body mass as determined by skin fold thickness measurements did not change significantly ($p > 0.05$ Table 7). The average total body weight at 10 weeks (66.6 ± 18.8 kg) was significantly lower ($p < 0.0002$; Table 7) than that at baseline (75.0 ± 21.9 kg). However, REE at 10 weeks (1705 ± 109 kcal) was not significantly different ($p > 0.05$; Table 7) from that at baseline (1685 ± 135 kcal)¹³⁵.

Body Composition and Resting Energy Expenditure after Weight Loss in Severely Overweight Children

(Sothorn, Loftin, et al, J Inves Med, 1999; Olivier, Sothorn, et al, Int'l J Obes, 2002)



Exercise and Caloric Restriction: Impact on Lipid Profiles:

Fifty subjects were enrolled in the comprehensive weight management program. Fasting total cholesterol, lipoprotein, and triglycerides levels were measured at baseline and after 10 weeks of participation¹⁶. Subjects were blocked by gender to observe between-groups differences in total cholesterol, triglycerides, LDL and HDL. Total cholesterol and triglycerides were significantly reduced in both genders. HDL was unchanged. However, LDL was significantly reduced in the female (132.55 ± 23.44 to 113.73 ± 16.75 mg/dl [$p < 0.26$]) but not male (114.00 ± 20.48 to 91.22 ± 26.07 mg/dl [$p < 0.68$]) children¹⁶. The baseline LDL was significantly above clinically recommended levels in females versus males. We have reported similar findings in observations between black and white obese children after caloric restriction, exercise and behavior modification.¹⁴

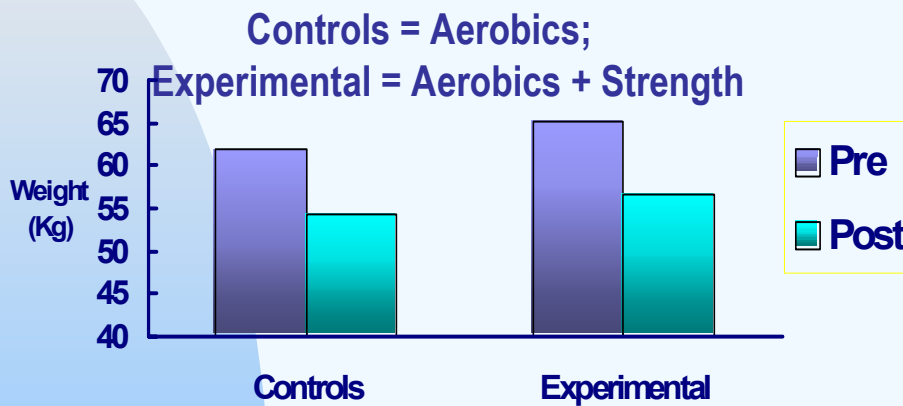
Exercise and Caloric Restriction: The Inclusion of Resistance (Strength) Training:

We examined the safety, feasibility, and level of compliance of a resistance-training program in a group of preadolescent obese children¹³⁴. Nineteen pre-adolescent obese children (7 male; 12 female) 7-12 years of age were enrolled into the comprehensive weight management program. Forty-eight control subjects (with a baseline age of <12 years) were selected from 12 cohorts of a similar hospital based program. Treatment subjects were prescribed the resistance-training program which consisted of a balanced routine of 6-12 different exercises specifically designed for obese youth in combination with exercise education to increase physical activity and structured aerobic activities¹³⁴. Control subjects were instructed to walk three times per week for 60 minutes at an intensity of 75-80% of HR max.

Treatment subjects reported no injuries or accidents during the one-year intervention period. A review of the treatment and control subjects' clinical files also revealed no additional physician visits associated with clinic-based or home-based exercise. Total body weight, %IBW, BMI, and % fat were decreased significantly in both treatment and control subjects (Table 8). Height was increased significantly and fat free body mass did not change significantly (Table 8). Fat free body, as determined by skin fold thickness measurements, increased significantly in the treatment subjects ($p < 0.0001$; Table 8). Fifteen of the treatment subjects completed the one-year program (78.9%). However, only 17 of the control subjects completed one year (20.8%). The decrease in total body weight and BMI over the 1-year period in both groups was significant ($p < 0.0003$). Post-hoc contrasts showed in the treatment subjects that the baseline weight was significantly higher than the weight at 10 weeks, and at 1-year follow-up ($p < 0.001$). However, in the control subjects the baseline weight was significantly higher than that at 10 weeks ($p < 0.0001$) but not significantly different than the weight at one year. The increase in height over the 1-year period in both groups was statistically significant ($p < 0.0001$). Post-hoc contrasts showed a significant increase in height from baseline, to 10 weeks ($p < 0.0001$ [treatment], $p < 0.002$ [control]), and to 1-year follow-up ($p < 0.001$ [treatment], $p < 0.009$ [control]). The inclusion of resistance training in weight management programs for obese children is safe, feasible and may result in improved compliance and retention^{133, 134}.

Moderate Intensity Progressive Exercise Program, Diet and Behavior Modification

Sothorn et al. *Am. J. Medical Sciences*, 2000



10-week Study (Retention: Experimental = 78.9%; Control = 35%)

These results were confirmed in a recent meta analysis by LeMura and colleagues, which examined 30 childhood obesity studies as follows:

Strength Training and Overweight Children (LeMura & Maziekas, Med Sci Sports Exer, 2002")

Moderate aerobic exercise, high-repetition resistance training and behavioral modification are most efficacious for reducing body fat variables in overweight children.

- A meta-analysis examined 30 childhood obesity treatment studies that included an exercise intervention.
- Significant improvements in body composition were associated with programs including low intensity aerobic and high-repetition strength training.

In summary, the PBRC and the Louisiana State University Health Sciences Center (Committed to Kids Pediatric Weight Management) have published numerous reports demonstrating significant improvements in obesity, lipid profiles, and aerobic endurance over three-month and one-year periods in overweight and obese children, 5-18 years of age in a clinical setting ^{14, 16,}

^{91, 134, 135, 160, 212} (Sothorn, 1999 #791)^{8, 133}.

Not only has the program been well tolerated by the children, their success in weight loss and weight maintenance at one year has also been very encouraging^{8, 91, 134, 212}. The CTK Pediatric Weight Management Program has been conducted at the Pennington Biomedical Research Center (PBRC) for several years. Children attending the program receive a comprehensive plan that promotes significant weight loss over a one-year period. Approximately 70% of the children that enroll in the program maintain approximately 30% of their weight loss after one year of attending the weekly program^{134, 212} (Sothorn, 1999 #791)⁸. However, to date this program has not been examined under randomized and controlled experimental conditions in a non-clinical environment. Furthermore, the intervention techniques have not been systematically applied to children at-risk for adult obesity due to an adolescent overweight condition.

Recently a version of the CTK model tailored to teens was implemented in 12-17 year olds as part of a FDA trial investigating the safety and efficacy of Meridia at the PBRC and the LSUHSC. We observed optimal compliance and retention using this approach in combination with drug or placebo. Berkowitz and others²¹⁵ recently published similar preliminary results using a comparable approach combining family, individual and peer group therapy in obese adolescents. Tailored, family and peer group behavioral interventions have not been systematically evaluated in obese adolescents an after school-based setting under randomized and controlled conditions.

Currently the CTK approach and Trim Kids book are being implemented in over 30 school based health centers in the state of Louisiana and in several school-based trials including the NIH funded TAAG and Wise mind studies.

(See also Section X. New Innovations for specific information on Trim Kids and Committed to Kids)

HIPTeens: Development of an Internet Approach for Obesity Prevention: (with permission from Don Williamson, PhD – Principal Investigator)

Advances in technology and the accompanying “internet revolution” have radically changed modern communication. The use of internet applications and electronic forms of communication continues to increase. In September of 2001, 143 million Americans (about 54 percent of the population) were using the internet, which was an increase of approximately 26 million over the

previous 13 months (U.S. Department of Commerce, 2002). Of all users, children and teenagers appear to use the internet more than any other age group. About ninety percent of children between the ages of 5 and 17 (47 million individuals) now use computers, and about 59% (31 million individuals) use the internet (U.S. Department of Education, 2003).

HIPTeens (Health Information Program for Teens).

The HIPTeens project (NIH 5 R01 HD39104-03) was designed to evaluate the efficacy of an internet-based intervention for weight loss in overweight African-American girls in a randomized clinical trial. The intervention that was tested in the study was planned to be secondary prevention study for overweight African-American girls. The study enrolled 57 African-American adolescent girls (ages 11 to 15 years) who were overweight (BMI > 85th percentile for girls) and had at least one biological parent who was obese (BMI \geq 30). The participants were randomly assigned to an interactive behavioral internet-based program or an internet-based health education program, the control condition. Parents of the girls were also participants in the study. Participants in both treatment groups met in face-to-face therapy sessions on four occasions over the first 12 weeks. In this project, two websites were developed and they will be adapted for use in the proposed project: an interactive behavioral internet-based program or an internet-based health education program. Data collection for this project will span two-years and will be completed in April 2004. The initial findings of the study are summarized below. The efficacy of this internet-based approach was established in this pilot study and serves as one empirical foundation for the proposed project.

HIPTeens

The efficacy of an internet-based lifestyle behavior modification program for obesity was tested in a randomized clinical trial using intent-to-treat statistical methodology. Over the course of six months of treatment, adolescents and parents in the behavioral treatment lost greater body fat/weight. Dietary fat intake was reduced for adolescents and parents in the behavioral treatment group. Utilization of the internet-based behavioral intervention was associated with decreased adiposity of the adolescents in the behavioral treatment group. Table 1 summarizes the main findings after six months of the project. For adolescents and parents, the behavioral program was more efficacious for fat/weight loss in comparison to the control group.

Table 1. Changes (\pm SE) in Body Fat, Body Weight, and BMI

	Adolescents		Parents	
<u>Measure</u>	<u>Behavioral</u>	<u>Control</u>	<u>Behavioral</u>	<u>Control</u>
% Body Fat	-1.12 \pm .47 ^{a↓}	0.43 \pm .47 ^b	-0.58 \pm .34	0.18 \pm .34
Body Weight (kg)	0.70 \pm .59	2.29 \pm .56	-2.43 \pm .66 ^{a↓}	-0.35 \pm .64 ^b
Body Mass Index	-0.19 \pm .24 ^a	0.65 \pm .23 ^{b↑}	-1.03 \pm .28 ^{a↓}	-0.06 \pm .77 ^b

Table Note: Superscripts (a,b) indicate that group means differ significantly ($p < .05$). Arrows ($\downarrow\uparrow$) indicate that difference scores differed ($p < .05$) from zero (baseline). For BMI, baseline BMI was a significant covariate ($p < .05$) for parents, but not adolescents. Percent body fat was measured using dual-energy absorptiometry (DEXA). It should be noted that adolescents in the behavioral group gained a small amount of body weight, but BMI was reduced due to increases in height over the six-months.

The HIPTeens program was designed to be a secondary prevention program for overweight African-American girls. The research sample was specified as girls with a BMI $> 85^{\text{th}}$ percentile based upon NHANES normative data for age and gender. We found that it was very difficult to recruit African-American girls with BMIs between 85 and 95. In fact, despite a very intensive community-wide recruitment strategy, we were able to recruit only 3 of 57 participants within this BMI range. We were surprised that with 18 months of recruitment, 95% of the girls had baseline values above the 95th percentile. This experience led us to conclude that obesity prevention for African-Americans should directly recruit from the community. It was this experience that led to the development of the Wise Mind project that recruited directly from schools. We also found that the participants generally enjoyed using the HIPTeens program. At the end of six months, 50 of 57 (88%) volunteers were retained in the study and at 18 months 41 participants (72%) were retained. Based upon these observations, we developed the proposed research plan that includes school-based recruitment and a school-based internet approach that is modeled after the HIPTeens websites. Since consumer satisfaction with both the behavioral and health education websites was high, we decided to use both in the proposed project. To prepare for the implementation of the website programs in a school environment, we are currently testing the feasibility of training teachers to use the HIPTeens behavioral program within the context of

health classes. This approach, which is described in greater detail below, will be used in the proposed project since we concluded that a clinic-based approach was insufficient for recruiting children and adolescents who are at-risk for overweight status. Many of the outcome measures that are proposed for this project were pilot tested in the HIPTeens study and they were found to be sensitive to change and/or mediate changes in body weight/fat.

The TAAG Study: Overview:

The Trial of Activity for Adolescent Girls (TAAG) is a collaborative, multi-center research study that focuses on the physical activity of adolescent girls in middle school. The trial is designed to test the effectiveness of a coordinated school and community based intervention to prevent the decline of physical activity in girls in middle school.

Six field centers are participating in TAAG: San Diego State University, San Diego; Tulane University, New Orleans; University of Minnesota, Minneapolis; University of Maryland, Baltimore; University of South Carolina, Columbia; University of Arizona, Tucson. TAAG is supported by the National Heart, Lung, and Blood Institute and the University of North Carolina at Chapel Hill serves as the coordinating center.

TAAG fosters school and community environments that encourage and support the full involvement of girls in every aspect of physical activity, including physical education (PE), recreation, and sport. The intervention is designed to reach these goals through a variety of approaches and channels including:

- Increasing girls' access to, availability and awareness of safe, appropriate, and fun opportunities to be physically active through school and community programs;
- Creating physical education programs that maximize girls' opportunities to be active during PE class, minimize barriers to activity, and nurture an enjoyment of physical activity that will last a lifetime;
- Creating social environments among peers, family, school members and the community at large that encourage, support, and facilitate physical activity by girls;
- Creating programs and activities that help girls develop the physical, behavioral, and communication skills necessary to choose to be active and to ask for the support for those choices;

- Helping girls to assess their current level of physical activity, to set realistic goals for activity and to develop a personal fitness program of appropriate frequency, duration, and intensity to increase or maintain their physical fitness; and
- Helping girls enjoy being active, feeling comfortable and confident in being active, and valuing being active, strong, and physically fit.

Benefits of Physical Activity during Adolescence

The benefits of regular physical activity during childhood and adolescence are numerous.

Among the benefits supported in the literature are the following:

- Improved cardiovascular functioning
- Increased muscular strength and power
- Improved motor skill development
- Enhanced peak bone mass
- Enhanced immune system responses
- Increased opportunities to develop positive self-concept and social interaction skills.
- Reduced risk for obesity and Type II diabetes
- Increased psychological and emotional well being, including reduced depression.
- Increased positive feelings about body image and self-esteem
- Increased energy and improved sleep patterns

Why Specifically Target Girls?

Young children are the most active segment of the population, but physical activity levels begin to decline as they approach their teenage years and continue into adulthood. Physical activity participation data indicate that many teenagers are at risk for sedentary living. For example, half those aged 12-21 years do not engage in vigorous physical activity on a regular basis.

Compared to boys, girls are particularly at risk from sedentary living and are unable to reap the benefits of regular physical activity. For example, compared to boys:

- Girls are less likely to be vigorously active (57% girls, 72% boys)
- Girls are less likely to participate in strengthening exercise (43% girls, 63% boys).
- Girls are less likely to participate on sports teams (48% girls, 61% boys)
- Girls' decline in physical activity is sharper than boys

- Middle school girls are less active during PE class, particularly during skill drills, game play, and free play.
- Middle school girls less likely to visit activity areas and be physically active before school, at lunchtime, or after school
- Hispanic and African-American girls are less likely than white girls to participate in moderate to vigorous activity.
- African-American girls are less likely to play on sports teams than white girls.
- Girls in grade 12 are less active and watch more television than 9th and 10th grade girls.

TAAG Components:

- TAAG Promotions
- TAAG Physical Education
- TAAG Community Partners After School Programs
- TAAG Health Education Curriculum

The TAAG study is currently in the first of a two-year intervention period and will be completed in the Spring of 2006.

Wisemind Wise Mind: Development of an Environmental Approach to Prevent of Weight Gain:
(with permission from Don Williamson, PhD – Principal Investigator)

The Wise Mind pilot project, is based on the principle that effective environmental interventions will require action at many different levels (e.g., in behavioral settings, with multiple enablers of behavior change, with the consent and support of administrators who are responsible for the environment that has been targeted for change. Our research team studied this list of potential environmental targets and concluded that the best target for our project would be a school system.

Research Design and Current Status.

The Wise Mind project (NIH 1 R01 DK063453-01) was initiated in October 2002. As noted earlier, the HIPTeens program was designed to be a secondary prevention approach. In contrast, the Wise Mind weight gain prevention program was designed as a primary prevention

approach that targets *inappropriate* (children and adolescents > 50th percentile) weight gain in the general school population. The research design of the Wise Mind study is similar to that used in the proposed study. Four schools were randomly assigned to a Weight Gain prevention program or to a substance abuse prevention program (control arm). We have now completed the development of the Wise Mind weight gain prevention program and this program has been implemented in two of the four schools. A third school that has a predominantly (99%) African-American student body also receives the weight gain prevention program in a separate study that is a part of a minority supplement (3 R01 DK063453-01S1). We have recruited 738 students to participate in the study. We have learned considerably from this initial recruitment experience. Within a six-week period, we recruited about 50% of the eligible students. We believe that with a longer recruitment period (at least six months), in schools with a two-year period of involvement with the LA GEAR UP project, we should be able to recruit at least 60% of the available students. We have collected baseline data at the five schools. Therefore, we have considerable experience in data collection within a school environment. We plan to use a very similar strategy in the proposed study. The first measurement of outcome will occur in March/April 2004, so we do not have preliminary data pertaining to the efficacy of this approach. The study is designed to collect data for two school years, ending in May 2005.

Wise Mind

We have now developed the Wise Mind environmental approach for weight gain prevention and the efficacy of this program is being tested in a pilot study. We have gathered baseline data and have gained valuable experience related to school-based recruitment. The following sections describe some of the preliminary findings.

Recruitment.

Of the 738 participants, 469 (63.5%) had BMIs > 50th percentile for age and gender and 233 (31.6%) had BMIs > 85th percentile. Therefore, our recruitment strategy yielded a sample that is represented by a distribution of BMI that is substantially higher than the NHANES national norms. We have concluded that the children of Louisiana form a population that is ideal for studies of prevention of *inappropriate* weight gain. Given the difficulty of recruiting the 57 HIPTeens participants, we were especially interested in the effectiveness of the school-based recruitment strategy for African-American children. During the six-week recruitment effort, we

enrolled 77 of the 169 (46%) African-American children. Of those 77 children, 57 (74%) had BMIs > 50th percentile and 32 (42%) had BMIs > 85th percentile. Therefore, we were very encouraged that this recruitment strategy was effective for recruiting African-American children who are at significant risk for chronic obesity.

Pilot study of the reliability and validity of outcome measures.

We conducted a pilot study to assess the measurement properties of the endpoints that were used in the Wise Mind project and will be used in the proposed study. One purpose of the study was to use digital photography of foods (see methods section below) to examine the repeatability of food intake measurement in a school environment. This test required measurement over five days. We determined the optimal number of days of food intake assessment required to obtain a reliable measure of food intake. An additional aim of the study was to determine if food intake correlated significantly with body weight and body fat. The study included 45 boys and girls in the sixth grade. Height was measured using a stadiometer. Weight was measured using Tanita (model TBF-310) scale that also measured body weight and body composition using body impedance assessment. Height and weight were converted to body mass index (BMI; kg/m²).

The descriptive characteristics of the sample are depicted in Table 2. The BMI percentile for boys was higher than that of girls.

Table 2. Mean age, percent body fat, and BMI percentile.

	All Participants (<i>n</i> = 45)	Boys (<i>n</i> = 23)	Girls (<i>n</i> = 22)
Age	11.71	11.74	11.68
Percent Body Fat	16.01	17.84	14.10
BMI Percentile	47.21	61.23	32.55

To evaluate inter-rater agreement, 30% of the lunches were over-sampled and both raters calculated food intake. Intra-class correlation coefficients were calculated for the raters for the following variables: total number of kcals. consumed, and kcals. consumed from carbohydrate, protein, and fat. In addition, intra-class correlation coefficients between the raters were calculated for percent of kcals. consumed from carbohydrate, protein, and fat. The raters

showed impressive agreement. The intra-class correlation coefficient for total kcal. intake was .88. The coefficients for calories consumed from carbohydrate, protein, and fat were .90, .93, and .86, respectively. The intra-class coefficients for percent kcals. from carbohydrate, protein, and fat that were consumed were .96, .94, and .96, respectively.

The repeatability of food intake was demonstrated over the five-day assessment period. The average kcals consumed per day are illustrated in Table 3. In order to determine the number of days of food intake assessment required to obtain a reliable measure of food intake, these pilot data were used to calculate the width of confidence intervals for each successive day of testing for a sample of 500 participants. As depicted in Table 4, the confidence interval width decreased markedly when food intake is assessed over two days instead of one. The confidence interval width also decreased when food intake is assessed for three versus two days. Assessing food intake beyond three days did not further improve the confidence interval. Based on this finding, we concluded that three days of food intake assessment using digital photography of foods is adequate to obtain a reliable measurement of food intake behavior in elementary school-aged children in a cafeteria, assuming a sample size of at least 500 participants.

Table 3. Mean food intake (kcals.) by day (*SD* are in parentheses). Mean intake over all five days is in bold (*n* = 43).

	Day 1	Day 2	Day 3	Day 4	Day 5	Days 1 - 5
Kcals.	638.1	576.9	690.8	653.1	598.2	628.8
consumed	(173.2)	(151.3)	(227.9)	(292.0)	(234.4)	(163.2)

Table 4. Confidence interval (C.I.) width, expressed in kcals, for each successive day of food intake assessment. Confidence interval width was calculated for a sample of 500 participants.

	Day 1	Day 2	Day 3	Day 4	Day 5
C.I. Width					
(<i>n</i> = 500)	38.59	32.65	30.42	29.23	28.50

Total food intake, expressed in kcals, for the entire sample was correlated with percentage of body fat and BMI percentile. Total food intake correlated significantly with percentage of body

fat ($r = .36$, $p = .02$) and BMI percentile ($r = .47$, $p = .002$). On average, boys consumed 697.56 ($SE = 29.92$) kcals during the test lunches and females consumed 549.76 ($SE = 32.08$) kcals. Boys ate significantly more than girls, $F(1, 41) = 11.35$, $p = .002$. Calories consumed from carbohydrate, protein, and fat were correlated with percentage body fat and BMI percentile for the entire sample and for each gender. Based upon these findings, we determined that the primary endpoints could be reliably and validly measured. Following this pilot study, we successfully gathered baseline data from 738 students enrolled in five schools during a period of approximately 25 school days.

XII Summary

It is well accepted that the environment of the family plays a key role in the development of obesity in young children at risk for adult obesity and related diseases such as diabetes. Research shows that parent inactivity strongly predicts child inactivity. Moreover, the exercise patterns of parents have a strong influence on the frequency of exercise in their children. Research also shows that parental influences are early determinants of food attitudes and practices in young children. And, furthermore, food preferences greatly influence the consumption patterns of young children. Therefore, strategies that positively alter the behaviors and environment of the family may reduce the risk of obesity and diabetes by improving physical activity and nutrition. This may prevent the onset of pediatric obesity and the risk of metabolic disease later in life, especially in those children with primary risk factors. Efforts to halt and reverse obesity and related metabolic disease, therefore, should begin with young children. More importantly, educational interventions that target the parents of children at risk for obesity should be an integral part of standard pediatric and family medical care. Educational interventions that provide early parent education concerning the risk factors for obesity, appropriate nutrition and physical activity for developing children are needed. This should occur at all levels: doctor's offices, hospitals, corporations, workplace, school and community organizations, mass media campaigns. Lastly, since children spend approximately 50% of their waking hours in school-related activities, the school environment should be a primary target for obesity prevention efforts.

XIII. Recommendations

Recommendations from the American Academy of Pediatrics ⁷²

Health supervision

1. Identify and track patients at risk by virtue of family history, birth weight, or socioeconomic, ethnic, cultural, or environmental factors.
2. Calculate and plot BMI once a year in all children and adolescents.
3. Use change in BMI to identify rate of excessive weight gain relative to linear growth.
4. Encourage, support, and protect breastfeeding.
5. Encourage parents and caregivers to promote healthy eating patterns by offering nutritious snacks, such as vegetables and fruits, low-fat dairy foods, and whole grains; encouraging children's autonomy in self-regulation of food intake and setting appropriate limits on choices; and modeling healthy food choices.
6. Routinely promote physical activity, including unstructured play at home, in school, in child care settings, and throughout the community.
7. Recommend limitation of television and video time to a maximum of 2 hours per day.
8. Recognize and monitor changes in obesity-associated risk factors for adult chronic disease, such as hypertension, dyslipidemia, hyperinsulinemia, impaired glucose tolerance, and symptoms of obstructive sleep apnea syndrome.

Advocacy

1. Help parents, teachers, coaches, and others who influence youth to discuss health habits, not body habitus, as part of their efforts to control overweight and obesity.
2. Enlist policy makers from local, state, and national organizations and schools to support a healthful lifestyle for all children, including proper diet and adequate opportunity for regular physical activity.
3. Encourage organizations that are responsible for health care and health care financing to provide coverage for effective obesity prevention and treatment strategies.

4. Encourage public and private sources to direct funding toward research into effective strategies to prevent overweight and obesity and to maximize limited family and community resources to achieve healthful outcomes for youth.
5. Support and advocate for social marketing intended to promote healthful food choices and increased physical activity.

The National Association for Sport and Physical Education (NASPE)

The National Association for Sport and Physical Education (NASPE) recently proposed increasing the recommended amount of physical activity for children. The first of four new guidelines recommends at least 60 minutes, and up to several hours of physical activity per day.

“With escalating obesity and physical inactivity rates for children, the public’s attention should now be focused to help schools and families across the country bring into action these important guidelines,” said NASPE President George Graham, Ph.D., of Pennsylvania State University. “Schools are critically important to increasing physical activity of children because school programs can affect the behavior of ALL children on a daily basis.”

Lead authors of the revised *Physical Activity for Children: A Statement of Guidelines for Children Ages 5-12*, are Drs. Charles B. Corbin and Robert P. Pangrazi of Arizona State University. The purpose of this document is to provide parents, physicians, physical education teachers, classroom teachers, youth physical activity leaders, school administrators, and all others dedicated to promoting physically active lifestyles for children with guidelines about appropriate physical activity for pre-adolescent children.

Summary Guidelines

Among the recommendations are the following:

1. Children should accumulate at least 60 minutes, and up to several hours, of age appropriate physical activity on all, or most days of the week.
2. Children should participate in several bouts of physical activity lasting 15 minutes or more each day.

3. Children should participate each day in a variety of age-appropriate physical activities designed to achieve optimal health, wellness, fitness and performance benefits.
4. Extended periods (periods of two hours or more) of inactivity are discouraged for children, especially during the daytime hours.

“To help bring these guidelines to fruition parents and schools need to set specific times each day for physical activity such as a before school activity, recess, physical education class, and an activity break after lunch,” said Charles Corbin. “Within a quality school physical education program, physical education teachers should:

1. Expose youngsters to a wide variety of physical activities
2. Teach physical skills to help maintain lifetime health and fitness
3. Encourage self-monitoring so youngsters can see how active they are and set their own goals
Individualize intensity of activities
4. Focus feedback on process of doing your best rather than on product
5. Be active role models.

“Perhaps the single most important time to increase physical activity and decrease sedentary activities such as television watching and computer time is after school between 3 and 6 p.m. This is a time when children can be active, but often are not. Many children are inactive during this time period through no fault of their own. Parents must help their children find safe and enjoyable opportunities to be active during this time period. Unless a special time is set aside each day, the opportunity to be active will slip away because barriers to physical activity are often great.”

When asked about barriers to promoting physical activity, the researcher said, “Without any question, the number one barrier to physical activity in schools is the perception that time spent in activity such as physical education and recess will undermine academic learning. The evidence does not support this assumption. We now know is that making time for physical

education and physical activity does not reduce academic learning and it may actually increase it.

“Our research shows that children who are physically active during the day in school are much more likely to be physically active after school as well. Energy begets energy! The more fit and alert adults feel the better they perform. This is also true for children.”

Corbin said, “The bottom line is that sedentary living contributes to obesity and chronic diseases later in life. Starting the activity habit early in life is crucial. Children need at least 60 minutes and up to several hours of activity daily. It can be accumulated in many short (15 minutes minimum) intermittent bouts of activity and need not be done in continuous exercise periods that are appropriate for adults. Long periods of inactivity (more than two hours in length) are discouraged.”

To order a copy of the new physical activity guidelines, visit the online bookstore at www.aahperd.org or call 1-800-321-0789. The cost is \$12 for NASPE/AAHPERD members, and \$16 for non-members. Stock number is 304-10276.

Information about the National Association for Sport and Physical Education (NASPE) can be found on the Internet at www.naspeinfo.org. NASPE, the largest of the six national associations of the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD), is a nonprofit membership organization of over 18,000 professionals in the fitness and physical activity fields. NASPE is the only national association dedicated to strengthening basic knowledge about sport and physical education among professionals and the general public. Putting that knowledge into action in schools and communities across the nation is critical to improved academic performance, social reform and the health of individuals.

Summary Recommendations:

The primary goal for solving the current childhood obesity epidemic is prevention of obesity during the early childhood years. This can only be accomplished if medical, public, private and school policy promotes the following:

***EFFORTS TO HALT AND REVERSE OBESITY AND RELATED METABOLIC DISEASE
SHOULD BEGIN WITH YOUNG CHILDREN.***

1. Educational interventions that target the parents of children at risk for obesity should be an integral part of standard pediatric and family medical care. Parent education programs should be encouraged and financially supported.
 - a. In children, from birth to 6 years, parental education is strongly recommended regardless of the child's current weight condition, especially if the parent(s) are obese.
 - b. Educational interventions that provide early parent education concerning the risk factors for obesity, appropriate nutrition and physical activity for developing children are needed.
 - c. Education should occur at all levels: doctor's offices, hospitals, corporations, workplace, school and community organizations, and mass media campaigns.
 - d. Educational programs should be designed to the individual cultural, gender and literacy level of the parents and the tendency to provide too much information too fast should be avoided.
 - e. The intervention should begin upon the first pregnancy visit to the Ob/Gyn doctor and could follow the same structure as natural child- birth and/or breastfeeding encouragement programs (See Appendix: Gerber Pediatrics Basics).
2. Children spend approximately 50% of their waking hours in school-related activities; the school environment should be a primary target for efforts to educate parents concerning obesity prevention.
3. The school environment should be a primary target for efforts to educate parents concerning the reduction of sedentary behaviors at home such as TV and computer games. Schools should be encouraged and provided resources to:
 - a. Integrate proven obesity prevention, school-based programs into the school curriculum to provide ongoing opportunities for school children to engage in and learn about healthy eating and physical activity (Planet Health, Catch, etc.).
 - b. Promote school-initiated programs that encourage parents to limit TV-watching, computer games and promote family physical activity (Robinson, et al, Pathways, Hip Teens, Wise Mind, Trim Kids, TAAG, etc).

4. School environments that offer healthy food choices and increased opportunities for physical activity should be promoted. This may include initiatives to remove vending machines that offer large-portion, unhealthy snacks and the discouragement of providing unhealthy food (pizza party, donut day, etc.) as rewards for good behavior or academic accomplishment.
5. Daily physical education class should be enforced and should include at least 30-60 minutes of moderate activity 5 times per week and 20 minutes of vigorous activity at least 3 times per week (Healthy People 2010). Classes should include strength, fun and entertaining aerobic activities (including sports and dance) and flexibility exercise
6. Schools should provide increased opportunities to engage in free or unstructured play in younger children during the school day—at least 15 minutes of recess in the morning, 30 minutes at lunch and 15 minutes in the afternoon to allow adequate opportunity to engage in moderate to vigorous physical activity.
7. Clinical pediatric obesity interventions should be delivered by a team of health care experts in a medically supervised, nurturing and non-intimidating environment.
 - a. At risk for overweight children and adolescents, 7 years or older, become increasingly more susceptible as they mature. Therefore, appropriate, targeted family-based dietary and physical activity interventions are recommended to prevent the onset of a clinically obese condition.
 - b. The attitude that the child will “grow into their weight” should be rejected as a myth if the child has one or more risk factor. Pediatricians and family physicians should, therefore, provide individual and /or group counseling opportunities to their patients who are above the 85th% BMI, especially if they have overweight parents.
 - c. Pediatrician and family physician based individual and group programs that utilize quality, clinically proven and scientifically tested approaches should be encouraged and financially supported for children who are at risk or already overweight.

- d. Cost effective individual and group approaches are available and should be both encouraged and financially supported by the medical community at large (Trim Kids, Healthy Solutions, etc.)
8. Children, 7 years or older, with clinically overweight or obese conditions require more comprehensive, structured and, in severe cases, aggressive dietary approaches. Strict medical supervision is absolutely necessary. Financial support for research is needed to determine the safest and most effective dietary and physical activity strategies for children with more severe conditions of obesity under randomized and controlled conditions over long-term periods.
9. More national, state and local funds are needed for programs that work simultaneously to conduct research and provide ongoing interventions to prevent and treat overweight children.
10. National, state and local funds are needed to examine community-wide promotional campaigns to prevent obesity in children.
11. Advocacy is needed in the areas of physical activity and food policy for children; research into pathophysiology, risk factors, and early recognition and management of overweight and obesity; and improved insurance coverage and third-party reimbursement for obesity care.

The current childhood overweight epidemic is not the fault or the responsibility of any one single sector of society. All must work together to develop strategies to change public opinion and behavior concerning healthy nutrition and physical activity across the life span. There are five major target areas that can be identified: 1) Family and home environment, 2) Public educators, administrators and school environment, 3) Health care, 4) Public policy, and 5) Public awareness. Each area offers a unique opportunity to develop and promote effective methods and provide resources for the prevention and treatment of overweight children (Table 1). A commitment on the part of one, two or three areas without the complete support of the others will only sabotage efforts. Only when all five areas *collectively* commit to providing the necessary resources will we realize a shift in this growing epidemic of childhood obesity.

Table 1: Target Areas - Prevention and Treatment of Overweight Children	
6. Family and Home environment	
a. Parental education and awareness	
b. Neighborhood safety	
7. Public Educators, Administrators and School environment	
a. Cafeteria environment	
b. Physical education environment	
c. Classroom environment	
d. After school and recess environment	
e. Non-food incentives for academic achievement and positive behavior	
8. Health care	
a. Ob/Gyn doctors	
i. Patient education	
ii. Monitoring of high-risk populations	
iii. Referral system	
b. Pediatrician, Family Physician, Dieticians, Psychologists, Exercise and related health care professionals	
i. Patient education	
ii. Monitoring of high-risk populations	
iii. Referral system	
iv. Prevention programs	
v. Treatment programs	
vi. Maintenance/Relapse prevention programs	
9. Public policy	
a. Insurance and governmental reimbursement for medical evaluation, monitoring prevention, treatment and maintenance programs	
b. Food labeling and packaging (portion control)	
c. School nutrition and physical activity policy	
i. Vending machine policy	
ii. Daily, unstructured physical activity periods (recess) and physical education class.	

iii. Limits on homework
iv. Federal and state grants or other funds to schools that promote and maintain a healthy school environment
d. Worksite policy (flex time, home offices, family and medical leave)
e. Youth media and marketing
f. Increased funding for childhood overweight research
10. Public awareness
a. Community programs
b. Promotions and Social Marketing Campaigns

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